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**RESULTS OF THE JULY 23-24, 2013  
RELATIVE ACCURACY TEST AUDIT OF THE  
CO/SO<sub>2</sub>/NO<sub>x</sub>/CO<sub>2</sub>/FLOW CEM SYSTEM INSTALLED  
ON THE NO. 9 BOILER OUTLET DUCT  
AT THE MANITOWOC PUBLIC UTILITIES  
FACILITY IN MANITOWOC, WISCONSIN**

Submitted to:

**Mechanical Systems Inc.**  
480 Progress Way  
Sun Prairie, WI 53590

Attention:

Rocky Orzechowski

Reviewed by:

Report Number 13-32333(No. 9)  
August 19, 2013  
DVH

*Kathleen Eickstadt*  
Kathleen Eickstadt  
Coordinator  
Source Testing

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## ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	dry standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (°F)	degrees Fahrenheit
DIA.	Diameter
FT/SEC	feet per second
g	gram
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g/dscm	grams per dry standard meter
HP	horsepower
HRS	hours
IN.	inches
IN.HG.	inches of mercury
IN.WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/ $10^6$ BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
MW	megawatt
mg/dscm	milligrams per dry standard cubic meter
ug/dscm	micrograms per dry standard cubic meter
microns (um)	micrometer
MIN.	minutes
ng	nanograms
PM	particulate matter
PPH	pounds per hour
PPM	parts per million
ppmC	parts per million carbon
ppm,d	parts per million, dry
ppm,w	parts per million, wet
ppt	parts per trillion
PSI	pounds per square inch
SQ.FT.	square feet
TPD	tons per day
ug	micrograms
v/v	percent by volume
w/w	percent by weight

Standard conditions are defined as 68 °F (20 °C) and 29.92 IN. of mercury pressure

## 1 INTRODUCTION

On July 23-24, 2013, Interpoll Laboratories personnel conducted a Relative Accuracy Test Audit (RATA) on the following Continuous Emission Monitoring (CEM) System installed on the Boiler 9 Outlet Duct at the Manitowoc Public Utilities Facility in Manitowoc, Wisconsin:

### Monitor

Type	Manufacturer	Model	Serial No.	Location
SO2	Thermo Electron	43i	43i0510511567	No. 9 Boiler
NOx	Thermo Electron	42i	42i0510511561	No. 9 Boiler
CO2	Thermo Electron	41i	410i0510511584	No. 9 Boiler
CO	Thermo Electron	48i	48i0510511587	No. 9 Boiler
Flow	United Sciences	150	1500188	No. 9 Boiler

On-site testing was performed by Aaron Wilson and Nate Beinemann. Coordination between testing activities and plant operation was provided by Jim Fanning of Mechanical Systems, Inc and Tim Harding of Manitowoc Public Utilities. The test was not witnessed by a representative of the Wisconsin Department of Natural Resources.

The RATA was performed in accordance with EPA Methods 3A, 6C, 7E and 10, CFR Title 40, Part 60, Appendix A (revised July 1, 2013) and per Part 75. For oxygen analysis, a slip stream of sample gas was withdrawn from the exhaust gas stream using test ports on the stack adjacent to the CEMS using a heat-traced probe and filter assembly. After passing through the filter, the gas passed through two condenser-type moisture removal systems operating in series. The particulate-free dry gas was then transported to the oxygen analyzer with the excess exhausted to the atmosphere through a calibrated orifice, which was used to ensure that the flow from the stack exceeds the requirements of the analyzer. For CO, SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> analysis, a dilution probe based system was used. In this system a slipstream of exhaust gas is drawn from the exhaust gas stream using an M&C dilution probe. The sample stream is filtered and diluted (approximate dilution during these tests was 100:1) before delivery to the analyzers. The analog response of the analyzers in both systems was recorded using a computer data logger. The analyzers were calibrated with EPA Protocol gases.

The important results of the test are summarized in the following tables. Field data and all other supporting information are presented in the appendices.

## **2 SUMMARY AND DISCUSSION**

The results of the Relative Accuracy Test Audit are summarized in the following tables. An overview of the results is presented below:

### **NO. 9 BOILER RELATIVE ACCURACY RESULTS**

<b>Parameter</b>	<b>Units</b>	<b>Measured</b>
NO <sub>x</sub>	LB/10 <sup>6</sup> BTU	6.77
NO <sub>x</sub>	ppm,w	3.69
SO <sub>2</sub>	ppm,w	6.03
SO <sub>2</sub>	LB/10 <sup>6</sup> BTU	8.63
CO <sub>2</sub>	% v/v,w	1.43
Flow (low)	SCFH	1.35
Flow (mid)	SCFH	2.98
CO	ppm,w	1.11
CO	LB/10 <sup>6</sup> BTU	1.03

No difficulties were encountered in the field or in the evaluation of the data. On the basis of these facts and a complete review of the data and results, it is our opinion that the CO<sub>2</sub>, SO<sub>2</sub> and NO<sub>x</sub> concentrations reported herein are accurate and closely reflect the actual values, which existed at the time the test was performed.

Summary of the Results of the July 23-24, 2013, Relative Accuracy Test Audit  
of the NO<sub>x</sub> Analyzer Installed on the No. 9 Boiler Breeching at the  
Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

**177 Klbs/Hr**

				Nox Lbs/mmBTU		
Run	Date	Time		RM	CEM	DIFF.
1	* 7/23-24/2013	21:15	-	21:35	0.128	0.118
2	7/23-24/2013	21:45	-	22:05	0.133	0.124
3	7/23-24/2013	22:15	-	22:35	0.114	0.108
4	7/23-24/2013	22:45	-	23:05	0.129	0.124
5	7/23-24/2013	23:15	-	23:35	0.122	0.114
6	7/23-24/2013	23:45	-	0:05	0.125	0.117
7	7/23-24/2013	0:20	-	0:40	0.108	0.102
8	7/23-24/2013	12:50	-	1:10	0.127	0.120
9	7/23-24/2013	1:20	-	1:40	0.148	0.140
10	7/23-24/2013	1:50	-	2:10	0.152	0.144
Average Diff.				0.129	0.122	0.007470
Standard Deviation						0.002
Confidence Coefficient						0.001271
Relative Accuracy						6.77
Bias Test						Fail
Bias Adjustment Factor						1.061

\* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 23-24, 2013, Relative Accuracy Test Audit  
 of the NO<sub>x</sub> Analyzer Installed on the No. 9 Boiler Breeching at the  
 Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

**177 Klbs/Hr**

Run	Date	Time	Nox ppm, wet		
			RM	CEM	DIFF.
1	*	7/23-24/2013 21:15 - 21:35	57.40	54.70	2.70
2	7/23-24/2013	21:45 - 22:05	58.70	57.50	1.20
3	7/23-24/2013	22:15 - 22:35	50.10	49.90	0.20
4	7/23-24/2013	22:45 - 23:05	56.60	56.90	-0.30
5	7/23-24/2013	23:15 - 23:35	53.80	52.40	1.40
6	7/23-24/2013	23:45 - 0:05	55.40	53.70	1.70
7	7/23-24/2013	0:20 - 0:40	48.70	47.00	1.70
8	7/23-24/2013	12:50 - 1:10	57.80	55.70	2.10
9	7/23-24/2013	1:20 - 1:40	67.20	64.80	2.40
10	7/23-24/2013	1:50 - 2:10	68.70	66.40	2.30
Average Diff.			57.444	56.033	1.411
Standard Deviation					0.925
Confidence Coefficient					0.711219
Relative Accuracy					3.69
Bias Test					Fail
Bias Adjustment Factor					1.025

\* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 23-24, 2013, Relative Accuracy Test Audit  
of the SO<sub>2</sub> Analyzer Installed on the No. 9 Boiler Breeching at the  
Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

**177 KIbs/Hr**

<b>Run</b>	<b>Date</b>	<b>Time</b>		<b>SO<sub>2</sub> ppm, wet</b>				
		<b>RM</b>	<b>CEM</b>	<b>DIFF.</b>				
1	7/23-24/2013	21:15	-	21:35	55.40	59.20	-3.80	
2	7/23-24/2013	21:45	-	22:05	74.20	71.70	2.50	
3	7/23-24/2013	22:15	-	22:35	82.00	82.60	-0.60	
4	7/23-24/2013	22:45	-	23:05	61.00	57.90	3.10	
5	7/23-24/2013	23:15	-	23:35	98.20	91.10	7.10	
6	7/23-24/2013	23:45	-	0:05	84.10	79.70	4.40	
7	7/23-24/2013	0:20	-	0:40	98.60	95.50	3.10	
8	7/23-24/2013	12:50	-	1:10	77.80	77.20	0.60	
9	7/23-24/2013	1:20	-	1:40	75.40	71.20	4.20	
10	*	7/23-24/2013	1:50	-	2:10	75.80	71.30	4.50
Average Diff.					78.522	76.233	2.288889	
Standard Deviation							3.180	
Confidence Coefficient							2.444204	
Relative Accuracy							6.03	
Bias Test							Pass	
Bias Adjustment Factor							1.030	
* Run was not used in Relative Accuracy calculation								
RM = Reference Method								
CEM = Continuous Emission Monitor								

Summary of the Results of the July 23-24, 2013, Relative Accuracy Test Audit  
of the SO<sub>2</sub> Analyzer Installed on the No. 9 Boiler Breeching at the  
Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

**177 Klbs/Hr**

<b>Run</b>	<b>Date</b>	<b>Time</b>	<b>SO<sub>2</sub> Lbs/mmBTU</b>		
			<b>RM</b>	<b>CEM</b>	<b>DIFF.</b>
1	7/23-24/2013	21:15 - 21:35	0.172	0.177	-0.005
2	7/23-24/2013	21:45 - 22:05	0.234	0.216	0.018
3	7/23-24/2013	22:15 - 22:35	0.259	0.249	0.010
4	7/23-24/2013	22:45 - 23:05	0.193	0.176	0.017
5	* 7/23-24/2013	23:15 - 23:35	0.310	0.277	0.033
6	7/23-24/2013	23:45 - 0:05	0.265	0.242	0.023
7	7/23-24/2013	0:20 - 0:40	0.305	0.287	0.018
8	7/23-24/2013	12:50 - 1:10	0.238	0.232	0.006
9	7/23-24/2013	1:20 - 1:40	0.231	0.213	0.018
10	7/23-24/2013	1:50 - 2:10	0.234	0.215	0.019
Average Diff.			0.237	0.223	0.013813
Standard Deviation					0.009
Confidence Coefficient					0.006625
Relative Accuracy					8.63
Bias Test					Fail
Bias Adjustment Factor					1.062
* Run was not used in Relative Accuracy calculation					
RM = Reference Method					
CEM = Continuous Emission Monitor					

Summary of the Results of the July 23-24, 2013, Relative Accuracy Test Audit  
 on the CO<sub>2</sub> Analyzer Installed on the No. 9 Boiler Breeching at the  
 Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

**177 Klbs/Hr**

				CO <sub>2</sub> , wet Summary			
Run	Date	Time		RM	CEM	DIFF.	
1	* 7/23-24/2013	21:15	-	21:35	10.00	10.20	-0.20
2	7/23-24/2013	21:45	-	22:05	9.90	10.10	-0.20
3	7/23-24/2013	22:15	-	22:35	9.90	10.10	-0.20
4	7/23-24/2013	22:45	-	23:05	9.90	10.00	-0.10
5	7/23-24/2013	23:15	-	23:35	9.90	10.00	-0.10
6	7/23-24/2013	23:45	-	0:05	9.90	10.00	-0.10
7	7/23-24/2013	0:20	-	0:40	10.10	10.10	0.00
8	7/23-24/2013	12:50	-	1:10	10.20	10.10	0.10
9	7/23-24/2013	1:20	-	1:40	10.20	10.20	0.00
10	7/23-24/2013	1:50	-	2:10	10.10	10.10	0.00
Average Difference				10.011	10.078	-0.06667	
Standard Deviation						0.100	
Confidence Coefficient						0.076867	
Relative Accuracy						1.43	
Bias Test						Pass	
Bias Adjustment Factor						0.993	

\* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 23-24, 2013, Relative Accuracy Test Audit  
 on the Flow Analyzer Installed on the No. 9 Boiler Breeching at the  
 Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

**177 Kilbs/Hr**

<b>Flow (SCFH) Summary</b>								
<b>Run</b>	<b>Date</b>	<b>Time</b>		<b>RM</b>	<b>CEM</b>			
1	*	7/23-24/2013	21:15	-	21:25	4,907,000	4,824,000	83,000
2		7/23-24/2013	21:45	-	21:55	4,861,000	4,811,000	50,000
3		7/23-24/2013	22:15	-	22:25	4,894,000	4,822,000	72,000
4		7/23-24/2013	22:45	-	22:55	4,857,000	4,811,000	46,000
5		7/23-24/2013	23:15	-	23:25	4,867,000	4,789,000	78,000
6		7/23-24/2013	23:45	-	23:55	4,847,000	4,807,000	40,000
7		7/23-24/2013	0:20	-	0:30	4,808,000	4,818,000	-10,000
8		7/23-24/2013	12:50	-	1:00	4,746,000	4,805,000	-59,000
9		7/23-24/2013	1:20	-	1:30	4,857,000	4,794,000	63,000
10		7/23-24/2013	1:50	-	2:00	4,791,000	4,811,000	-20,000
Average Difference				4836444.444	4807555.556	28888.88889		
Standard Deviation						47332.453		
Confidence Coefficient						36382.878906		
Relative Accuracy						1.35		
Bias Test						Pass		
Bias Adjustment Factor						1.006		
* Run was not used in Relative Accuracy calculation								
RM = Reference Method								
CEM = Continuous Emission Monitor								

Results of the July 24, 2013 Relative Accuracy Test Audit  
 of the Flow Analyzer Installed on the No. 9 Boiler Breeching at the  
 Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

Run	Date	Time		Flow (SCFH)		
				RM	CEM	DIFF.
1	07/24/13	11:10	-	6,294,000	6,233,000	61,000
2	* 07/24/13	11:17	-	5,762,000	6,270,000	-508,000
3	07/24/13	11:24	-	5,890,000	6,275,000	-385,000
4	07/24/13	11:40	-	6,359,000	6,238,000	121,000
5	07/24/13	11:47	-	6,438,000	6,238,000	200,000
6	07/24/13	11:54	-	6,360,000	6,247,000	113,000
7	07/24/13	12:08	-	6,319,000	6,224,000	95,000
8	07/24/13	12:15	-	6,347,000	6,204,000	143,000
9	07/24/13	12:22	-	6,291,000	6,211,000	80,000
10	07/24/13	12:29	-	6,295,000	6,215,000	80,000
Average Diff.				6288111.111	6231666.667	56444.444
Confidence Coefficient						131168.699355
Standard Deviation						170644.448
Relative Accuracy						2.98
Bias Test						Pass
Bias Adjustment Factor						1.00905768

\* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 23-24, 2013, Relative Accuracy Test Audit  
of the CO Analyzer Installed on the No. 9 Boiler Breeching at the  
Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

**177 KIbs/Hr**

Run	Date	Time	CO ppm, wet		
			RM	CEM	DIFF.
1	7/23-24/2013	21:15 - 21:35	13.30	15.30	-2.00
2	7/23-24/2013	21:45 - 22:05	17.50	15.00	2.50
3	7/23-24/2013	22:15 - 22:35	17.70	14.90	2.80
4	7/23-24/2013	22:45 - 23:05	17.10	13.60	3.50
5	7/23-24/2013	23:15 - 23:35	15.30	12.80	2.50
6	7/23-24/2013	23:45 - 0:05	15.10	17.40	-2.30
7	*	0:20 - 0:40	15.90	20.40	-4.50
8	7/23-24/2013	12:50 - 1:10	14.80	18.80	-4.00
9	7/23-24/2013	1:20 - 1:40	17.00	17.80	-0.80
10	7/23-24/2013	1:50 - 2:10	17.20	18.20	-1.00
Average Diff.			16.111	15.978	0.133333
Standard Deviation					2.724
Confidence Coefficient					2.093823
Relative Accuracy calculated using applicable standard of 200 ppm					1.11
Bias Test					Pass
Bias Adjustment Factor					1.008

\* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

\*\* Calculated in accordance with CFR, Part 60, App. B, PS 4A, 13.2. Using the applicable standard. Applicable standard for the source is 200 ppm. An alternative method of calculation is also allowed in which the average difference, plus the confidence coefficient, must be less than 5 ppmv.

Summary of the Results of the July 23-24, 2013, Relative Accuracy Test Audit  
of the CO Analyzer Installed on the No. 9 Boiler Breeching at the  
Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

Run	Date	Time	CO Lbs/mmBTU		
			RM	CEM	DIFF.
1	7/23-24/2013	21:15 - 21:35	0.018	0.020	-0.002
2	7/23-24/2013	21:45 - 22:05	0.024	0.020	0.004
3	7/23-24/2013	22:15 - 22:35	0.024	0.020	0.004
4	*	22:45 - 23:05	0.024	0.018	0.006
5	7/23-24/2013	23:15 - 23:35	0.021	0.017	0.004
6	7/23-24/2013	23:45 - 0:05	0.021	0.023	-0.002
7	7/23-24/2013	0:20 - 0:40	0.022	0.027	-0.005
8	7/23-24/2013	12:50 - 1:10	0.020	0.025	-0.005
9	7/23-24/2013	1:20 - 1:40	0.023	0.023	0.000
10	7/23-24/2013	1:50 - 2:10	0.023	0.024	-0.001
Average Diff.			0.022	0.022	0.000274
Standard Deviation					0.004
Confidence Coefficient					0.002801
Relative Accuracy (using applicable standard 0.3)					1.03
Bias Test					Pass
Bias Adjustment Factor					1.013
* Run was not used in Relative Accuracy calculation					
RM = Reference Method					
CEM = Continuous Emission Monitor					

**APPENDIX A**

**SAMPLING EQUIPMENT CALIBRATION DATA**

**INTERPOL LABORATORIES, INC.**  
**(763) 786-6020**

**Temperature Measurement Device Calibration Sheet**

**Unit under Test:**

Vendor	Cen Tech	Serial Number	6048682
Model	92242	Thermocouple Type	Type K
Range	0-2000	Technician	Mike Bonham
Date of Calibration	8/2/2012	PDT Number	138

**Method of Calibration:**

Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is +/- 0.1 % of span(2100 of) +/- 1 degree (for negative temperatures add +/- 2 degrees). The CL-300 simulated exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp. (°F) Nominal	Response of Unit Under Test (°F)	Deviation	
		Δt (°F)	%
0	9	9	1.919
100	103	3	0.533
200	210	10	1.493
300	304	4	0.524
400	405	5	0.578
500	501	1	0.104
600	605	5	0.469
700	700	0	0.000
800	804	4	0.316
900	901	1	0.073
1000	1006	6	0.409
1100	1103	3	0.192
1200	1204	4	0.240
1300	1301	1	0.057
1400	1404	4	0.215
1500	1503	3	0.153
1600	1604	4	0.194
1700	1700	0	0.000
1800	1800	0	0.000
1900	1901	1	0.042
2000	2000	0	0.000
2100			
<b>Average:</b>		<b>3.24</b>	<b>0.3577</b>

OF = off scale response by unit under test (oF)

% dev =  $100|\Delta t|/(460+|t|)$

Unit was in tolerance

Unit was not in tolerance : Recalibrated see new calibration sheet or

( Must be within +/- 1.5% absolute reference temperature )

**INTERPOL LABORATORIES, INC.**  
 (763) 786-6020

**Temperature Measurement Device Calibration Sheet**

**Unit under Test:**

Vendor Omega  
 Model hh-81  
 Range 0-2100 °F  
 Date of Calibration 4/5/2013

Serial Number 201108  
 Thermocouple Type Type K  
 Technician D Van Hoever  
 PDT Number 85

**Method of Calibration:**

Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is +/- 0.1 % of span(2100 oF) +/- 1 degree (for negative temperatures add +/- 2 degrees). The CL-300 simulated exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp. (°F) Nominal	Response of Unit Under Test (°F)	Deviation	
		Δ t (°F)	%
0	1	1	0.217
100	101	1	0.179
200	204	4	0.606
300	303	3	0.395
400	401	1	0.116
500	500	0	0.000
600	603	3	0.283
700	700	0	0.000
800	803	3	0.238
900	902	2	0.147
1000	1004	4	0.274
1100	1104	4	0.256
1200	1204	4	0.241
1300	1305	5	0.284
1400	1404	4	0.215
1500	1505	5	0.255
1600	1605	5	0.243
1700	1703	3	0.139
1800	1802	2	0.088
1900	1903	3	0.127
2000			
2100	OF		
Average:		3	0.215

OF = off scale response by unit under test (oF)

% dev =  $100|\Delta t|/(460+|t|)$

Unit was in tolerance

Unit was not in tolerance : Recalibrated see new calibration sheet or  
 ( Must be within +/- 1.5% absolute reference temperature )  
 unit put out of service.

INTERPOLL LABORATORIES, INC.  
(763) 786-6020

**Stack Sampling Department - QA  
Field Barometer Calibration Sheet**

Date: 4/5/2013  
Technician: Aaron Wilson  
Mercury Column Barometer Number: Weighing Room Barometer  
Aneroid Barometer Number: NO.1 (2109004)

Reference Mercury Barometer Reading	Ambient Temperature	Temperature Correction Factor	Adjusted Mercury Barometer Reading	Initial Field Barometer Reading	Difference ( $P_{ba} - P_{bm}$ )
29.27	76	0.124	29.15	29.13	-0.016

**Weighing room barometer setup:**

- 1) Using the set screw on the bottom of the barometer, adjust the level of the mercury reservoir to the point that the level indicator makes slight contact with the mercury. A flashlight can aid in seeing the dimple formed when the level indicator makes contact with the mercury.
- 2) Slide the measurement ruler on the barometer to the point where the bottom of the ruler is in line with the top of the mercury column's reverse meniscus. Record the reading (in. Hg)
- 3) Take a temperature reading and record the temperature correction factor from the lookup table near the barometer.
- 4) Apply the temperature correction factor to the mercury barometer.
- 5) Adjust the field barometer reading to within +/- 0.1 in. Hg of the reference barometer reading.

Has this barometer shown any consistent problems with calibration? Has the problem been alleviated? \_\_\_\_\_

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Note: Aneroid barometers will be calibrated periodically against a mercury column barometer. The aneroid barometer to be calibrated should be placed in close proximity to the mercury barometer and left to equilibrate for 20 - 30 minutes before calibrating. Aneroid barometer will be calibrated to the adjusted mercury barometer readings.

**Alternative Calibration Procedure:**

- 1) Obtain the station value or absolute barometric pressure  $P_r$  from a nearby National Weather Service station and its elevation (A) in feet above sea level.
- 2) Determine the elevation (B) in feet above sea level of the site of the field barometer.(local airport)
- 3) Calculate the site barometric pressure ( $P_b$ ) as follows:  
$$P_b = P_r + 0.001 (A-B)$$
- 4) Compare the field barometer reading against  $P_b$  obtained in step 3.
- 5) Adjust the field barometer reading to within +/- 0.1 in. Hg.



Environmental Supply Company, Inc.

Quality Source Sampling Systems & Accessories

## Wind Tunnel Pitot Calibration

Customer: Interpol Laboratories

S-type Pitot ID: 04-S+P1 Date: 1-Apr-13  
Standard Pitot ID: 001 Personnel: DH  
Cp(std): 0.99 Cp(actual): 0.831  
Part Number: P(bar): 29.35  
Test Velocity (fps): 30 - 60 - 90 T(°F): 56

Calibration Results				
Velocity (fps)	Nominal ΔPs [inches H <sub>2</sub> O]	Cp <sub>(s)</sub> A-Side	Cp <sub>(s)</sub> B-Side	Cp <sub>(s)</sub> Average
30	0.284	0.834	0.835	0.835
60	1.142	0.829	0.833	0.829
90	2.623	0.824	0.833	0.828
Overall Average				0.831

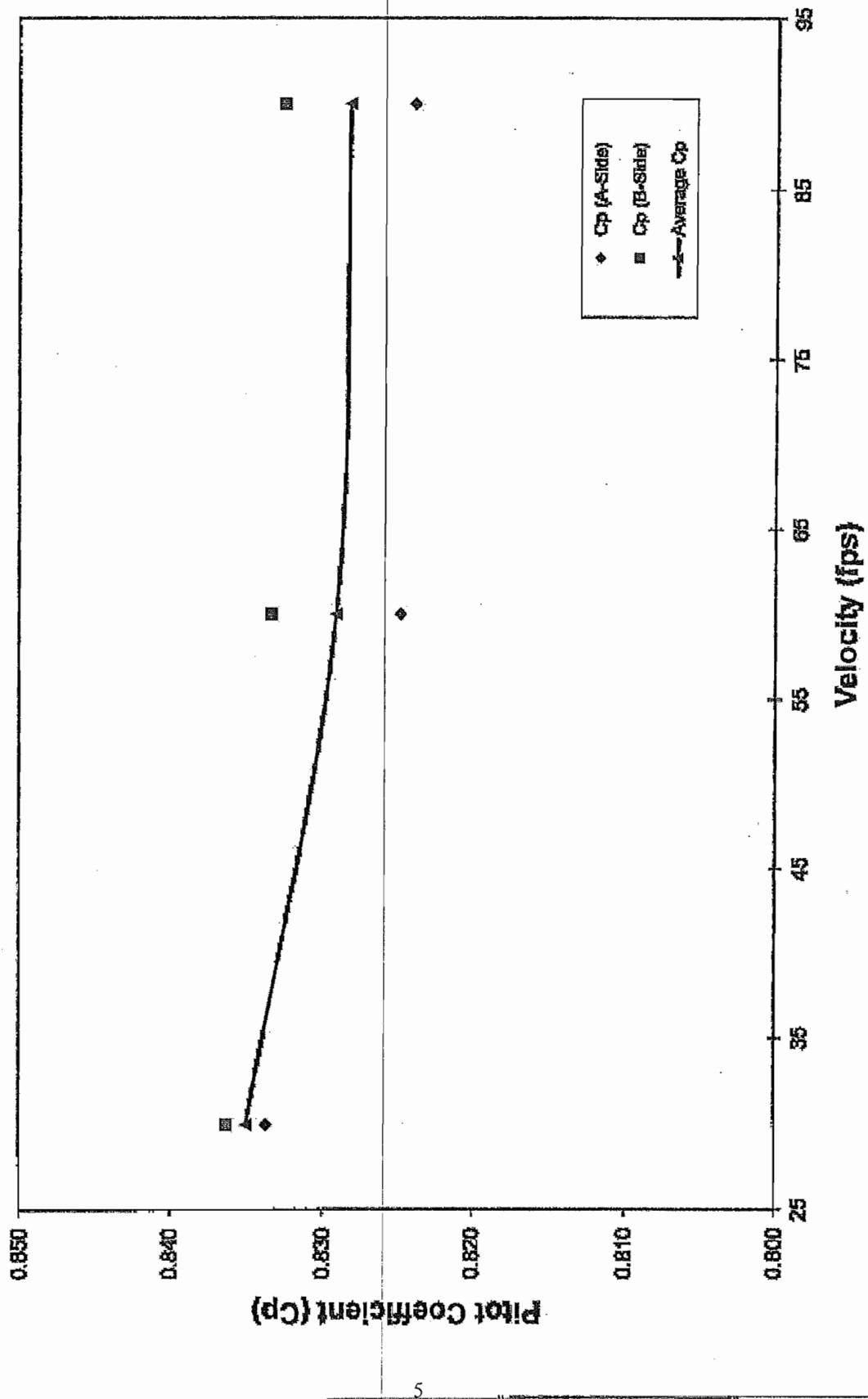
Pitot tube S/N 04-S+P1 was calibrated in accordance with the Code of Federal Regulations, Title 40, Part 60 Appendix A, Method 2, Section 10.

Dan M. Harde  
Signature

4/1/13  
Date

# S-Type Pitot (S/N 04-5+P1) - Pitot Coefficient (C<sub>p</sub>) vs Velocity (fps)

Environmental Supply Company Wind Tunnel - 04/01/2013





Environmental Supply Company, Inc.

Quality Source Sampling Systems &amp; Accessories

## Wind Tunnel Pitot Calibration

S-type Pitot ID: **04-5+P1** Date: **1-Apr-13**  
 Standard Pitot ID: **001** Personnel: **DH**  
 Cp(std): **0.99** Cp(actual): **0.835**  
 Part Number:  
 Test Velocity (fps): **30** P(bar): **29.35**  
 T(°F): **56**

A-SIDE	$\Delta P_{std}$ (in. H <sub>2</sub> O)	$\Delta P_s$ (in. H <sub>2</sub> O)	Cp(s)	Deviation*
	<b>0.202</b>	<b>0.283</b>	<b>0.837</b>	<b>0.003</b>
	<b>0.202</b>	<b>0.285</b>	<b>0.834</b>	<b>0.000</b>
	<b>0.202</b>	<b>0.286</b>	<b>0.831</b>	<b>-0.003</b>
	<b>0.201</b>	<b>0.285</b>	<b>0.833</b>	<b>-0.001</b>
	<b>AVERAGE</b>		<b>0.834</b>	<b>0.002</b>
			Std deviation	<b>0.003</b>

B-SIDE	$\Delta P_{std}$ (in. H <sub>2</sub> O)	$\Delta P_s$ (in. H <sub>2</sub> O)	Cp(s)	Deviation*
	<b>0.202</b>	<b>0.282</b>	<b>0.839</b>	<b>0.003</b>
	<b>0.202</b>	<b>0.283</b>	<b>0.836</b>	<b>0.000</b>
	<b>0.202</b>	<b>0.284</b>	<b>0.835</b>	<b>-0.002</b>
	<b>0.201</b>	<b>0.283</b>	<b>0.835</b>	<b>-0.001</b>
	<b>AVERAGE</b>		<b>0.836</b>	<b>0.001</b>
			Std deviation	<b>0.002</b>

$$Cp(s) = Cp(std) \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$Cp(A) - Cp(B) = \boxed{0.003} \text{ (must be } < 0.010\text{)}$$

\*Deviation = {Cp(s) - AVG Cp(s)} {must be <0.010}

Standard deviation of the deviations must be less than 0.02 for both

Pitot tube S/N 04-5+P1 was calibrated in accordance with the CFR 40, Part 60 Appendix A, Method 2, Section 10.



Environmental Supply Company, Inc.

Quality Source Sampling Systems &amp; Accessories

## Wind Tunnel Pitot Calibration

S-type Pitot ID: **04-5+P1** Date: **1-Apr-13**  
Standard Pitot ID: **001** Personnel: **DH**  
**Cp(std): 0.99** **Cp(actual): 0.829**  
Part Number:  
Test Velocity (fps): **60** P(bar): **29.95**  
T(°F): **56**

A-SIDE	$\Delta P_{std}$ (in. H <sub>2</sub> O)	$\Delta P_s$ (in. H <sub>2</sub> O)	Cp(s)	Deviation*
	<b>0.799</b>	<b>1.154</b>	<b>0.824</b>	-0.001
	<b>0.803</b>	<b>1.153</b>	<b>0.827</b>	0.002
	<b>0.800</b>	<b>1.152</b>	<b>0.825</b>	0.000
	<b>0.802</b>	<b>1.159</b>	<b>0.824</b>	-0.001
	<b>AVERAGE</b>		<b>0.825</b>	0.001
			Std deviation	0.001

B-SIDE	$\Delta P_{std}$ (in. H <sub>2</sub> O)	$\Delta P_s$ (in. H <sub>2</sub> O)	Cp(s)	Deviation*
	<b>0.799</b>	<b>1.132</b>	<b>0.832</b>	-0.002
	<b>0.803</b>	<b>1.129</b>	<b>0.835</b>	0.002
	<b>0.800</b>	<b>1.130</b>	<b>0.833</b>	0.000
	<b>0.802</b>	<b>1.131</b>	<b>0.834</b>	0.000
	<b>AVERAGE</b>		<b>0.833</b>	0.001
			Std deviation	0.001

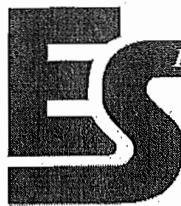
$$Cp(s) = Cp(std) \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$Cp(A) - Cp(B) = \boxed{0.009} \text{ (must be } < 0.010\text{)}$$

$$*Deviation = \{Cp(s) - AVG Cp(s)\} \text{ (must be } < 0.010\text{)}$$

Standard deviation of the deviations must be less than 0.02 for both

Pitot tube S/N 04-5+P1 was calibrated in accordance with the CFR 40, Part 60 Appendix A, Method 2, Section 10.



Environmental Supply Company, Inc.

Quality Source Sampling Systems &amp; Accessories

## Wind Tunnel Pitot Calibration

S-type Pitot ID: **04-5+P1** Date: **1-Apr-13**  
 Standard Pitot ID: **001** Personnel: **DH**  
 Cp(std): **0.99** Cp(actual): **0.828**  
 Part Number: P(bar): **29.35**  
 Test Velocity (fps): **90** T(°F): **56**

A-SIDE	$\Delta P_{std}$ (in. H <sub>2</sub> O)	$\Delta P_s$ (in. H <sub>2</sub> O)	Cp(s)	Deviation*
	<b>1.837</b>	<b>2.657</b>	<b>0.823</b>	-0.001
	<b>1.836</b>	<b>2.652</b>	<b>0.824</b>	0.000
	<b>1.832</b>	<b>2.642</b>	<b>0.824</b>	0.001
	<b>1.837</b>	<b>2.651</b>	<b>0.824</b>	0.000
	<b>AVERAGE</b>		<b>0.824</b>	0.000
			Std deviation	0.001

B-SIDE	$\Delta P_{std}$ (in. H <sub>2</sub> O)	$\Delta P_s$ (in. H <sub>2</sub> O)	Cp(s)	Deviation*
	<b>1.837</b>	<b>2.603</b>	<b>0.832</b>	-0.001
	<b>1.836</b>	<b>2.594</b>	<b>0.833</b>	0.000
	<b>1.832</b>	<b>2.588</b>	<b>0.833</b>	0.000
	<b>1.837</b>	<b>2.597</b>	<b>0.833</b>	0.000
	<b>AVERAGE</b>		<b>0.833</b>	0.000
			Std deviation	0.001

$$Cp(s) = Cp(std) \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$Cp(A) - Cp(B) = \boxed{0.009} \quad \text{must be <0.010}$$

\*Deviation = {Cp(s) - AVG Cp(s)} {must be <0.010}

Standard deviation of the deviations must be less than 0.02 for both

Pitot tube S/N 04-5+P1 was calibrated in accordance with the CFR 40, Part 60 Appendix A, Method 2, Section 10.

## **APPENDIX B**

### **FIELD DATA SHEETS**

**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job Source	MSI / Manitowoc PU No. 9 Boiler					
Test	2N	Run	1	Date	7/23-24/2013	
Stack Diameter (in.)	108					
Dry Bulb (°F)	310		Wet Bulb (°F)	137		
Moisture Content (%)				12.36		
Monometer				Normal		
Barometric Pressure				29.29		
Static Pressure +/-				-0.69		
Operators				AW / NB		
Pitot No.	04-5+-P1		Pitot Coeff.	0.831		
177 Klbs/Hr						
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)	
		Port Length (in.):	11.50		Start Time:	9:15 PM
A-1	0.032	3.46	14.96	0.210	310	
A-2	0.105	11.34	22.84	0.230	310	
A-3	0.194	20.95	32.45	0.220	310	
A-4	0.323	34.88	46.38	0.220	310	
A-5	0.677	73.12	84.62	0.210	310	
A-6	0.806	87.05	98.55	0.210	310	
A-7	0.895	96.66	108.16	0.220	310	
A-8	0.968	104.54	116.04	0.220	310	
B-1				0.220	308	
B-2				0.220	308	
B-3				0.210	308	
B-4				0.180	308	
B-5				0.220	308	
B-6				0.250	308	
B-7				0.240	308	
B-8				0.290	308	
Digital Numbers Used:			85 / 138	End Time:	9:25 PM	

**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run	2	Date	7/23-24/2013
Stack Diameter (in.)		108			
Dry Bulb (°F)	313			Wet Bulb (°F)	136
Moisture Content (%)				11.75	
Monometer				Normal	
Barometric Pressure				29.29	
Static Pressure +/-				-0.69	
Operators				AW / NB	
Pitot No.	04-5+-P1			Pitot Coeff.	0.831
177 Klbs/Hr					
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50		Start Time: 9:45 PM
A-1	0.032	3.46	14.96	0.190	313
A-2	0.105	11.34	22.84	0.180	313
A-3	0.194	20.95	32.45	0.170	313
A-4	0.323	34.88	46.38	0.170	313
A-5	0.677	73.12	84.62	0.210	313
A-6	0.806	87.05	98.55	0.200	313
A-7	0.895	96.66	108.16	0.190	313
A-8	0.968	104.54	116.04	0.190	313
B-1				0.210	310
B-2				0.190	310
B-3				0.220	310
B-4				0.200	310
B-5				0.260	310
B-6				0.310	310
B-7				0.330	310
B-8				0.340	310
Digital Numbers Used:			85 / 138	End Time:	9:55 PM



**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU		
Source	No. 9 Boiler		
Test	2N	Run <u>4</u>	Date <u>7/23-24/2013</u>
Stack Diameter (in.)	108		
Dry Bulb (°F)	310	Wet Bulb (°F)	136
Moisture Content (%)	11.71		
Monometer	Normal		
Barometric Pressure	29.29		
Static Pressure +/-	0.70		
Operators	AW / NB		
Pitot No.	04-5+-P1	Pitot Coeff.	0.831

177 Klbs/Hr

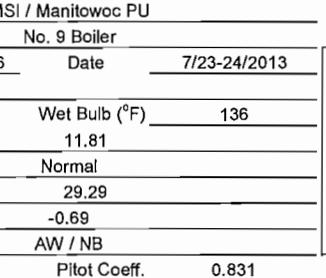
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):		11.50	Start Time: 10:45 PM
A-1	0.032	3.46	14.96	0.230	310
A-2	0.105	11.34	22.84	0.210	310
A-3	0.194	20.95	32.45	0.200	310
A-4	0.323	34.88	46.38	0.210	310
A-5	0.677	73.12	84.62	0.230	310
A-6	0.806	87.05	98.55	0.230	310
A-7	0.895	96.66	108.16	0.220	310
A-8	0.968	104.54	116.04	0.210	310
B-1				0.200	312
B-2				0.200	312
B-3				0.190	312
B-4				0.210	312
B-5				0.210	312
B-6				0.220	312
B-7				0.250	312
B-8				0.280	312
Digital Numbers Used:	85 / 138	End Time:	10:55 PM		

**Interpoll Laboratories**  
**(763) 786-6020**

**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run	5	Date	7/23-24/2013
Stack Diameter (in.)	108				
Dry Bulb (°F)	310		Wet Bulb (°F)	136	
Moisture Content (%)				11.83	
Manometer			Normal		
Barometric Pressure			29.29		
Static Pressure +/-			-0.70		
Operators			AW / NB		
Pitot No.	04-5+-P1		Pitot Coeff.	0.831	
				177 Kibs/Hr	
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.): 11.50		Start Time:	11:15 PM
A-1	0.032	3.46	14.96	0.240	310
A-2	0.105	11.34	22.84	0.230	310
A-3	0.194	20.95	32.45	0.210	310
A-4	0.323	34.88	46.38	0.220	310
A-5	0.677	73.12	84.62	0.230	310
A-6	0.806	87.05	98.55	0.210	310
A-7	0.895	96.66	108.16	0.220	310
A-8	0.968	104.54	116.04	0.220	310
B-1				0.180	309
B-2				0.170	309
B-3				0.180	309
B-4				0.200	309
B-5				0.250	309
B-6				0.240	309
B-7				0.260	309
B-8				0.270	309
Digital Numbers Used:		85 / 138		End Time:	11:25 PM

**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU			 Cross-section View      Elevation View	
Source	No. 9 Boiler				
Test	2N	Run	6		
Stack Diameter (in.)	108	Date	7/23-24/2013		
Dry Bulb (°F)	311	Wet Bulb (°F)	136		
Moisture Content (%)			11.81		
Monometer			Normal		
Barometric Pressure			29.29		
Static Pressure +/-			-0.69		
Operators			AW / NB		
Pitot No.	04-5+-P1	Pitot Coeff.	0.831		
177 Kibs/Hr					
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	11:45 PM
A-1	0.032	3.46	14.96	0.220	311
A-2	0.105	11.34	22.84	0.230	311
A-3	0.194	20.95	32.45	0.210	311
A-4	0.323	34.88	46.38	0.220	311
A-5	0.677	73.12	84.62	0.230	311
A-6	0.806	87.05	98.55	0.200	311
A-7	0.895	96.66	108.16	0.210	311
A-8	0.968	104.54	116.04	0.200	311
B-1				0.200	309
B-2				0.190	309
B-3				0.200	309
B-4				0.230	309
B-5				0.240	309
B-6				0.220	309
B-7				0.250	309
B-8				0.240	309
Digital Numbers Used:      85 / 138      End Time:      11:55 PM					

**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run	7	Date	7/23-24/2013
Stack Diameter (in.)	108				
Dry Bulb (°F)	312	Wet Bulb (°F)			137
Moisture Content (%)	12.27				
Monometer	Normal				
Barometric Pressure	29.29				
Static Pressure +/-	-0.71				
Operators	AW / NB				
Pitot No.	04-5+P1				Pitot Coeff. 0.831
177 Klbs/Hr					
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	12:20 AM
A-1	0.032	3.46	14.96	0.210	312
A-2	0.105	11.34	22.84	0.200	312
A-3	0.194	20.95	32.45	0.220	312
A-4	0.323	34.88	46.38	0.210	312
A-5	0.677	73.12	84.62	0.190	312
A-6	0.806	87.05	98.55	0.210	312
A-7	0.895	96.66	108.16	0.210	312
A-8	0.968	104.54	116.04	0.200	312
B-1				0.180	311
B-2				0.190	311
B-3				0.220	311
B-4				0.230	311
B-5				0.230	311
B-6				0.250	311
B-7				0.250	311
B-8				0.240	311
Digital Numbers Used:		85 / 138	End Time:	12:30 AM	

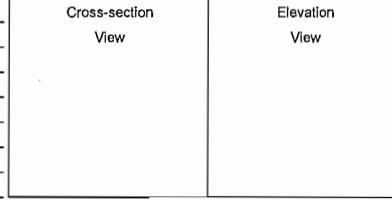
**Interpoll Laboratories**  
**(763) 786-6020**

**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU					
Source	No. 9 Boiler					
Test	2N	Run <u>8</u>	Date <u>7/23-24/2013</u>			
Stack Diameter (in.)	108				Cross-section View	Elevation View
Dry Bulb (°F)	<u>311</u>			Wet Bulb (°F) <u>137</u>		
Moisture Content (%)	12.28					
Monometer	Normal					
Barometric Pressure	29.29					
Static Pressure +/-	-0.07					
Operators	AW / NB					
Pitot No.	<u>04-5+-P1</u>		Pitot Coeff.	<u>0.831</u>	177 Klbs/Hr	
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)	
		Port Length (in.):	<u>11.50</u>		Start Time:	<u>12:50 PM</u>
A-1	<u>0.032</u>	<u>3.46</u>	<u>14.96</u>	<u>0.190</u>	<u>311</u>	
A-2	<u>0.105</u>	<u>11.34</u>	<u>22.84</u>	<u>0.200</u>	<u>311</u>	
A-3	<u>0.194</u>	<u>20.95</u>	<u>32.45</u>	<u>0.180</u>	<u>311</u>	
A-4	<u>0.323</u>	<u>34.88</u>	<u>46.38</u>	<u>0.190</u>	<u>311</u>	
A-5	<u>0.677</u>	<u>73.12</u>	<u>84.62</u>	<u>0.200</u>	<u>311</u>	
A-6	<u>0.806</u>	<u>87.05</u>	<u>98.55</u>	<u>0.220</u>	<u>311</u>	
A-7	<u>0.895</u>	<u>96.66</u>	<u>108.16</u>	<u>0.210</u>	<u>311</u>	
A-8	<u>0.968</u>	<u>104.54</u>	<u>116.04</u>	<u>0.200</u>	<u>311</u>	
B-1				<u>0.180</u>	<u>310</u>	
B-2				<u>0.190</u>	<u>310</u>	
B-3				<u>0.200</u>	<u>310</u>	
B-4				<u>0.210</u>	<u>310</u>	
B-5				<u>0.200</u>	<u>310</u>	
B-6				<u>0.250</u>	<u>310</u>	
B-7				<u>0.260</u>	<u>310</u>	
B-8				<u>0.270</u>	<u>310</u>	
Digital Numbers Used:	<u>85 / 138</u>			End Time:	<u>1:00 AM</u>	



**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU					
Source	No. 9 Boiler					
Test	2N	Run	10	Date		7/23-24/2013
Stack Diameter (in.)	108					
Dry Bulb (°F)	312					
Moisture Content (%)	Wet Bulb (°F) 136 11.74					
Monometer	Normal					
Barometric Pressure	29.29					
Static Pressure +/-	-0.07					
Operators	AW / NB					
Pitot No.	04-5+-P1		Pitot Coeff.	0.831		
177 Klbs/Hr						
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)	
			Port Length (in.):	11.50		
				Start Time:	1:50 AM	
A-1	0.032	3.46	14.96	0.200	312	
A-2	0.105	11.34	22.84	0.200	312	
A-3	0.194	20.95	32.45	0.220	312	
A-4	0.323	34.88	46.38	0.230	312	
A-5	0.677	73.12	84.62	0.210	312	
A-6	0.806	87.05	98.55	0.190	312	
A-7	0.895	96.66	108.16	0.180	312	
A-8	0.968	104.54	116.04	0.190	312	
B-1				0.190	310	
B-2				0.200	310	
B-3				0.220	310	
B-4				0.210	310	
B-5				0.200	310	
B-6				0.250	310	
B-7				0.270	310	
B-8				0.260	310	
Digital Numbers Used:		85 / 138		End Time:	2:00 AM	

**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU			
Source	No. 9 Boiler			
Test	2M	Run	1	Date 7/24/2013
Stack Diameter (in.)			108	
Dry Bulb (°F)	330		Wet Bulb (°F)	138
Moisture Content (%)				12.01
Monometer			Fluid	
Barometric Pressure				29.44
Static Pressure +/-				-0.39
Operators				AW / NB
Pitot No.	04-5+-P1			Pitot Coeff. 0.8310

Cross-section View	Elevation View
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300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
	Port Length (in.):				
A-1	0.032	3.46	14.96	0.430	330
A-2	0.105	11.34	22.84	0.410	330
A-3	0.194	20.95	32.45	0.390	330
A-4	0.323	34.88	46.38	0.380	330
A-5	0.677	73.12	84.62	0.360	330
A-6	0.806	87.05	98.55	0.380	330
A-7	0.895	96.66	108.16	0.370	330
A-8	0.968	104.54	116.04	0.380	330
B-1				0.350	331
B-2				0.340	331
B-3				0.340	331
B-4				0.330	331
B-5				0.370	331
B-6				0.410	331
B-7				0.420	331
B-8				0.430	331

Digital Numbers Used:	85 / 138	End Time:	11:16 AM
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**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run	2		
Stack Diameter (in.)	Date 7/24/2013				
Dry Bulb (°F)	108				
Dry Bulb (°F)	330	Wet Bulb (°F)	139		
Moisture Content (%)	12.54				
Monometer	Fluid				
Barometric Pressure	29.44				
Static Pressure +/-	-0.34				
Operators	AW / NB				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8310		
				300 Klbs/Hr	
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	11:17 AM
A-1	0.032	3.46	14.96	0.350	330
A-2	0.105	11.34	22.84	0.320	330
A-3	0.194	20.95	32.45	0.310	330
A-4	0.323	34.88	46.38	0.270	330
A-5	0.677	73.12	84.62	0.270	330
A-6	0.806	87.05	98.55	0.270	330
A-7	0.895	96.66	108.16	0.280	330
A-8	0.968	104.54	116.04	0.270	330
B-1				0.320	331
B-2				0.330	331
B-3				0.360	331
B-4				0.330	331
B-5				0.340	331
B-6				0.340	331
B-7				0.360	331
B-8				0.380	331
Digital Numbers Used:		85 / 138		End Time:	11:23 AM





**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job Source	MSI / Manitowoc PU				Cross-section View	Elevation View
	2M	Run	5	Date		
Test				7/24/2013		
Stack Diameter (in.)			108			
Dry Bulb (°F)	332		Wet Bulb (°F)	141		
Moisture Content (%)			13.57			
Monometer			Fluid			
Barometric Pressure			29.44			
Static Pressure +/-			-0.34			
Operators			AW / NB			
Pitot No.	04-5+P1		Pitot Coeff.	0.8310		
300 Klbs/Hr						
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)	
		Port Length (in.):	11.50		Start Time:	
A-1	0.032	3.46	14.96	0.390	11:47 AM	
A-2	0.105	11.34	22.84	0.380	332	
A-3	0.194	20.95	32.45	0.430	332	
A-4	0.323	34.88	46.38	0.430	332	
A-5	0.677	73.12	84.62	0.440	332	
A-6	0.806	87.05	98.55	0.460	332	
A-7	0.895	96.66	108.16	0.470	332	
A-8	0.968	104.54	116.04	0.450	332	
B-1				0.380	331	
B-2				0.370	331	
B-3				0.380	331	
B-4				0.360	331	
B-5				0.360	331	
B-6				0.350	331	
B-7				0.380	331	
B-8				0.320	331	
Digital Numbers Used:		85 / 138		End Time:	11:53 AM	

**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run	6	Date	
Stack Diameter (in.)	108				
Dry Bulb (°F)	333	Wet Bulb (°F)	141		
Moisture Content (%)	13.53				
Monometer	Fluid				
Barometric Pressure	29.44				
Static Pressure +/-	-0.34				
Operators	AW / NB				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8310		
300 Kibs/Hr					
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	11:54 AM
A-1	0.032	3.46	14.96	0.410	333
A-2	0.105	11.34	22.84	0.380	333
A-3	0.194	20.95	32.45	0.330	333
A-4	0.323	34.88	46.38	0.320	333
A-5	0.677	73.12	84.62	0.320	333
A-6	0.806	87.05	98.55	0.340	333
A-7	0.895	96.66	108.16	0.330	333
A-8	0.968	104.54	116.04	0.340	333
B-1				0.380	332
B-2				0.380	332
B-3				0.400	332
B-4				0.420	332
B-5				0.420	332
B-6				0.470	332
B-7				0.480	332
B-8				0.500	332
Digital Numbers Used:		85 / 138	End Time:	12:00 PM	

**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job Source	MSI / Manitowoc PU				
	No. 9 Boiler				
Test	2M	Run	7	Date	
Stack Diameter (in.)	108			7/24/2013	
Dry Bulb (°F)	334			Wet Bulb (°F)	
Moisture Content (%)	12.94			140	
Monometer	Fluid				
Barometric Pressure	29.44				
Static Pressure +/-	-0.35				
Operators	AW / NB				
Pitot No.	04-5+-P1			Pitot Coeff.	
				0.8310	
300 Klbs/Hr					
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	12:08 PM
A-1	0.032	3.46	14.96	0.420	334
A-2	0.105	11.34	22.84	0.390	334
A-3	0.194	20.95	32.45	0.380	334
A-4	0.323	34.88	46.38	0.350	334
A-5	0.677	73.12	84.62	0.340	334
A-6	0.806	87.05	98.55	0.340	334
A-7	0.895	96.66	108.16	0.330	334
A-8	0.968	104.54	116.04	0.340	334
B-1				0.390	335
B-2				0.340	335
B-3				0.350	335
B-4				0.350	335
B-5				0.410	335
B-6				0.440	335
B-7				0.490	335
B-8				0.500	335
Digital Numbers Used:		85 / 138		End Time:	12:14 PM

**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job

Source

Test

Stack Diameter (in.)

Dry Bulb (°F)

Moisture Content (%)

Monometer

Barometric Pressure

Static Pressure +/-

Operators

Pitot No.

**MSI / Manitowoc PU****No. 9 Boiler**

2M	Run	8	Date	7/24/2013	Cross-section View	Elevation View
			108			
335			Wet Bulb (°F)	140		
				12.90		
			Fluid			
			29.44			
			-0.33			
			AW / NB			
04-5+-P1			Pitot Coeff.	0.8310		

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
	Port Length (in.):	11.50		Start Time:	12:15 PM
A-1	0.032	3.46	14.96	0.440	335
A-2	0.105	11.34	22.84	0.420	335
A-3	0.194	20.95	32.45	0.370	335
A-4	0.323	34.88	46.38	0.350	335
A-5	0.677	73.12	84.62	0.340	335
A-6	0.806	87.05	98.55	0.380	335
A-7	0.895	96.66	108.16	0.370	335
A-8	0.968	104.54	116.04	0.390	335
B-1				0.360	336
B-2				0.330	336
B-3				0.340	336
B-4				0.340	336
B-5				0.390	336
B-6				0.420	336
B-7				0.490	336
B-8				0.490	336
Digital Numbers Used:	85 / 138		End Time:	12:21 PM	

**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run	9	Date	
Stack Diameter (in.)				108	
Dry Bulb (°F)	336			Wet Bulb (°F)	
Moisture Content (%)				140	
Monometer				12.87	
Barometric Pressure				Fluid	
Static Pressure +/-				29.44	
Operators				-0.35	
Pitot No.	04-5+-P1		Pitot Coeff.	0.8310	
300 Klbs/Hr					
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	12:22 PM
A-1	0.032	3.46	14.96	0.430	336
A-2	0.105	11.34	22.84	0.390	336
A-3	0.194	20.95	32.45	0.340	336
A-4	0.323	34.88	46.38	0.330	336
A-5	0.677	73.12	84.62	0.370	336
A-6	0.806	87.05	98.55	0.360	336
A-7	0.895	96.66	108.16	0.380	336
A-8	0.968	104.54	116.04	0.380	336
B-1				0.350	336
B-2				0.350	336
B-3				0.360	336
B-4				0.340	336
B-5				0.390	336
B-6				0.410	336
B-7				0.440	336
B-8				0.490	336
Digital Numbers Used:		85 / 138	End Time:	12:28 PM	

**Interpoll Laboratories**  
**(763) 786-6020**  
**EPA Method 2 Field Data Sheet**

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run	10	Date	
Stack Diameter (in.)	108			7/24/2013	
Dry Bulb (°F)	338	Wet Bulb (°F)		140	
Moisture Content (%)	12.80				
Monometer	Fluid				
Barometric Pressure	29.44				
Static Pressure +/-	-0.37				
Operators	AW / NB				
Pitot No.	04-5+-P1	Pitot Coeff.		0.8310	
300 Klbs/Hr					
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):		11.50	Start Time:
A-1	0.032	3.46	14.96	0.430	338
A-2	0.105	11.34	22.84	0.390	338
A-3	0.194	20.95	32.45	0.330	338
A-4	0.323	34.88	46.38	0.340	338
A-5	0.677	73.12	84.62	0.350	338
A-6	0.806	87.05	98.55	0.360	338
A-7	0.895	96.66	108.16	0.380	338
A-8	0.968	104.54	116.04	0.380	338
B-1				0.370	337
B-2				0.340	337
B-3				0.330	337
B-4				0.340	337
B-5				0.380	337
B-6				0.430	337
B-7				0.490	337
B-8				0.500	337
Digital Numbers Used:		85 / 138		End Time:	12:35 PM

## **APPENDIX C**

### **REFERENCE METHOD COMPUTER PRINTOUTS**



**MSI / Manitowoc PU**

**Manitowoc, WI**

**No. 9 Boiler**

**7/23-24/2013**

**Run 1**

<b>Time</b>	<b>SO<sub>2</sub> ppm, w</b>	<b>Nox ppm, w</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>	<b>CO ppm, w</b>
21:10	44.7	61.82	9.129	10.16	12.83
21:11	46.25	61.88	9.184	10.09	13.25
21:12	50.44	60.4	9.114	10.16	13.31
21:13	54.31	59.33	9.113	10.08	12.05
21:14	55.6	56.86	9.129	10.14	13.1
21:15	58.62	57.58	9.157	10.12	13.32
21:16	58.97	56.03	9.205	10.02	12.38
21:17	58.58	57.94	9.332	9.942	11.82
21:18	58.37	56.16	9.436	9.921	11.39
21:19	58.12	55.16	9.381	9.916	14.42
21:20	59.87	54.84	9.335	9.959	14.16
21:21	62.02	54.51	9.29	9.923	12.65
21:22	60.22	55.08	9.27	9.945	13.26
21:23	54.77	57.03	9.381	9.806	12.18
21:24	46.9	54.65	9.446	9.825	14.51
21:25	46.24	55.86	9.371	9.881	14.57
21:26	37.62	60.44	9.245	10.01	12.97
21:27	45.95	56.41	9.192	9.984	13.45
21:28	63.28	53.59	9.241	9.947	14.42
21:29	69.54	53.43	9.264	9.905	14.14
21:30	78.09	53.16	9.232	9.956	14.18
<b>Average</b>	<b>55.641</b>	<b>56.770</b>	<b>9.259</b>	<b>9.985</b>	<b>13.255</b>

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/23-24/2013  
Test 2N  
177 Kib/Hr

Run 2

#### Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.190	0.436	313	
2	A-2	0.180	0.424	313	
3	A-3	0.170	0.412	313	
4	A-4	0.170	0.412	313	
5	A-5	0.210	0.458	313	
6	A-6	0.200	0.447	313	
7	A-7	0.190	0.436	313	
8	A-8	0.190	0.436	313	
9	B-1	0.210	0.458	310	
10	B-2	0.190	0.436	310	
11	B-3	0.220	0.469	310	
12	B-4	0.200	0.447	310	
13	B-5	0.260	0.510	310	
14	B-6	0.310	0.557	310	
15	B-7	0.330	0.574	310	
16	B-8	0.340	0.583	310	9:55 PM
Average		0.223	0.469	312	

#### Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	312	
Wet Bulb (°F)	136.0	Static Pressure
TRA	1.13	Pilot Coefficient
Vapor Pressure of Water	5.30	
ZT	175.50	Duct Width (in.)
PM	343.66	Duct Length (in.)
Barometric Pressure	29.29	Duct Area (ft <sup>2</sup> )
Moisture Content	11.75	Stack Diameter (in.)
O <sub>2</sub> %	9.224	Stack Area (ft <sup>2</sup> )
CO <sub>2</sub> %	11.216	
Standard CFH	4,861,324	Molecular Weight (dry)
K Standard CFH	81.022	Molecular Weight (wet)
		Stack Pressure
		Feet per Second
		Actual CFM
		DSCFM
		121143.6
		71499.25

#### Field Calculations

##### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O <sub>2</sub> (dry)	9.38	0.14	10.86	10.70	9.22
CO <sub>2</sub> (wet)	9.86	0.02	8.27	8.30	9.90
NOx (wet)	57.73	0.13	49.59	50.40	58.70
SO <sub>2</sub> (wet)	74.92	0.08	50.13	49.60	74.18
CO (wet)	17.49	0.08	50.65	50.80	17.49
Moisture	11.75			Standard CFH	4,861,324
Fuel Factor	1877			K Standard CFM	81.022
DSCFM	71499				

#### Results

Start Stop	9:45 PM 9:55 PM	Gases Start Gases Stop	9:45 PM 10:05 PM
CO <sub>2</sub> %, wet	9.9		
NOX ppm, wet	58.7		
NOx LB/mmBTU	0.133		
SO <sub>2</sub> ppm, wet	74.2		
SO <sub>2</sub> LB/mmBTU	0.234		
CO ppm, wet	17.49		
CO LB/mmBTU	0.024		
SCFH	4,861,000		
WAF applied	0.9950		

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/23-24/2013**  
**Run 2**

<b>Time</b>	<b>SO<sub>2</sub> ppm, w</b>	<b>Nox ppm, w</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>	<b>CO ppm, w</b>
21:45	63.9	57.12	9.189	9.975	16.15
21:46	59.48	60.34	9.272	9.867	16.91
21:47	60.7	59.93	9.414	9.666	18.4
21:48	65.01	60.19	9.483	9.664	14.89
21:49	69.46	59.43	9.491	9.722	17.59
21:50	71.04	58.7	9.504	9.721	17.13
21:51	76.9	57.1	9.457	9.794	14.73
21:52	77.32	56.89	9.46	9.852	16.26
21:53	71.74	57.99	9.446	9.856	17.71
21:54	74.49	56.46	9.426	9.821	17.36
21:55	80.31	57.19	9.423	9.84	18.11
21:56	76.01	58.44	9.458	9.759	17.3
21:57	79.22	54.97	9.538	9.778	18.11
21:58	86.95	54.84	9.468	9.838	20.14
21:59	86.43	55.35	9.387	9.887	19.48
22:00	86.56	54.21	9.365	9.922	17.69
22:01	86.79	55.64	9.281	10.05	18.53
22:02	82.73	55.67	9.192	10.1	18.87
22:03	75.95	58.48	9.194	10.04	16.91
22:04	69.85	60.91	9.236	9.976	17.85
22:05	72.54	62.44	9.211	9.899	17.212
<b>Average</b>	<b>74.923</b>	<b>57.728</b>	<b>9.376</b>	<b>9.858</b>	<b>17.492</b>

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/23-24/2013  
Test 2N Run 3  
177 KIbs/Hr

#### Volumetric Flow Rate Data

Number of Sample Points		16		
Point Number	Delta p	Sq. root	Temperature	Time
1	A-1	0.190	0.436	313
2	A-2	0.190	0.436	313
3	A-3	0.200	0.447	313
4	A-4	0.210	0.458	313
5	A-5	0.230	0.480	313
6	A-6	0.220	0.469	313
7	A-7	0.210	0.458	313
8	A-8	0.220	0.469	313
9	B-1	0.210	0.458	311
10	B-2	0.210	0.458	311
11	B-3	0.220	0.469	311
12	B-4	0.240	0.490	311
13	B-5	0.230	0.480	311
14	B-6	0.250	0.500	311
15	B-7	0.280	0.529	311
16	B-8	0.270	0.520	311
Average		0.224	0.472	312

#### Moisture Content Data

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	312		
Wet Bulb (°F)	135.0	Static Pressure	-0.69
TRA	1.13	Pilot Coefficient	0.831
Vapor Pressure of Water	5.17		
ZT	177.00	Duct Width (in.)	0.00
PM	328.37	Duct Length (in.)	0.00
Barometric Pressure	29.29	Duct Area (ft <sup>2</sup> )	0.00
Moisture Content	11.23	Stack Diameter (in.)	108.00
O <sub>2</sub> %	9.377	Stack Area (ft <sup>2</sup> )	63.62
CO <sub>2</sub> %	11.098	Molecular Weight (dry)	30.151
Standard CFH	4,894,397	Molecular Weight (wet)	28.786
K Standard CFH	81.573	Stack Pressure	29.239
Fuel Factor		Feet per Second	31.974
DSCFM		Actual CFM	122046.82
		DSCFM	72412.35

#### Field Calculations

Raw Data Table				
Instrument	ppm or %	Zero	Span	Cylinder Value
O <sub>2</sub> (dry)	9.49	0.14	10.81	10.7
CO <sub>2</sub> (wet)	9.83	0.02	8.29	8.3
NOx (wet)	49.30	0.08	49.57	50.4
SO <sub>2</sub> (wet)	83.10	0.06	50.29	49.6
CO (wet)	17.65	0.12	50.48	50.80
Moisture	11.23			9.38
Fuel Factor	1877			9.85
DSCFM	72412			50.12
				82.01
				17.69
				4,894,397
				81.573

#### Results

	Start	Stop	Gases Start	Gases Stop
CO <sub>2</sub> %, wet	9.9		10:15 PM	10:15 PM
NOX ppm, wet	50.1		10:25 PM	10:35 PM
NOx LB/mmbtu	0.114			
SO <sub>2</sub> ppm, wet	82.0			
SO <sub>2</sub> LB/mmbtu	0.269			
CO ppm, wet	17.69			
CO LB/mmbtu	0.024			
SCFH	4,894,000			
WAF applied	0.9950			

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/23-24/2013**  
**Run 3**

<b>Time</b>	<b>SO<sub>2</sub> ppm, w</b>	<b>Nox ppm, w</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>	<b>CO ppm, w</b>
22:15	83.89	50.85	9.288	9.697	18.77
22:16	86.52	48.21	9.336	9.67	17.46
22:17	94.8	46.83	9.354	9.685	19.65
22:18	93.91	45.52	9.343	9.757	19.67
22:19	88.78	45.85	9.248	9.795	16.04
22:20	82.72	47.87	9.256	9.782	16.89
22:21	80.52	48.88	9.275	9.774	18.29
22:22	80.1	48.71	9.275	9.821	19.74
22:23	83.4	48.03	9.258	9.855	18.81
22:24	86	47.84	9.189	9.801	16.75
22:25	82.78	48.42	9.228	9.846	16.75
22:26	85.29	47.22	9.248	9.893	18.45
22:27	92.33	47.06	9.179	9.89	17.94
22:28	91.4	48.43	9.131	9.923	18.22
22:29	88.87	50.45	9.359	9.943	17.29
22:30	86.98	50.09	10.24	9.952	18.03
22:31	77.64	51.73	10.32	9.971	18.25
22:32	74.04	51.22	10.08	9.916	17.06
22:33	72.21	52.45	10.04	9.961	17.36
22:34	68.11	54.88	9.817	9.919	14.26
22:35	64.87	54.73	9.849	9.59	15.01
<b>Average</b>	<b>83.103</b>	<b>49.299</b>	<b>9.491</b>	<b>9.831</b>	<b>17.652</b>

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/23-24/2013  
Test 2N Run 4  
177 Klbs/Hr

#### Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta_p</u>	<u>Sq. root delta_p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.230	0.480	310	10:45 PM
2	A-2	0.210	0.458	310	
3	A-3	0.200	0.447	310	
4	A-4	0.210	0.458	310	
5	A-5	0.230	0.480	310	
6	A-6	0.230	0.480	310	
7	A-7	0.220	0.469	310	
8	A-8	0.210	0.458	310	
9	B-1	0.200	0.447	312	
10	B-2	0.200	0.447	312	
11	B-3	0.190	0.436	312	
12	B-4	0.210	0.458	312	
13	B-5	0.210	0.458	312	
14	B-6	0.220	0.469	312	
15	B-7	0.250	0.500	312	
16	B-8	0.280	0.529	312	10:55 PM
Average		0.219	0.467	311	

<u>Moisture Content Data</u>		<u>Flow Rate Data</u>
Dry Bulb (°F)	311	
Wet Bulb (°F)	136.0	Static Pressure
TRA	1.13	Pitot Coefficient
Vapor Pressure of Water	5.30	
ZT	175.00	Duct Width (in.)
PM	343.54	Duct Length (in.)
Barometric Pressure	29.29	Duct Area (ft <sup>2</sup> )
Moisture Content	11.71	Stack Diameter (in.)
O <sub>2</sub> %	9.245	Stack Area (ft <sup>2</sup> )
CO <sub>2</sub> %	11.158	63,617,251.2
Standard CFH	4,857,361	Molecular Weight (dry)
K Standard CFH	80.956	Molecular Weight (wet)
		Stack Pressure
		Feet per Second
		Actual CFM
		120,545.02
		DSCFM
		7,147.739

#### Field Calculations

##### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O <sub>2</sub> (dry)	9.32	0.16	10.77	10.7	9.24
CO <sub>2</sub> (wet)	9.76	0.04	8.23	8.3	9.85
NOx (wet)	56.06	0.06	49.96	50.4	56.57
SO <sub>2</sub> (wet)	61.76	0.10	50.27	49.6	60.96
CO (wet)	17.05	0.10	50.42	50.80	17.11
Moisture	11.71				
Fuel Factor	1877				
DSCFM	71477				
				4,857,361	
				80.956	

##### Results

Start Stop	10:45 PM 10:55 PM	Gases Start Gases Stop	10:45 PM 11:05 PM
CO <sub>2</sub> %, wet	9.9		
NOX ppm, wet	56.6		
NOx LB/mmBTU	0.129		
SO <sub>2</sub> ppm, wet	61.0		
SO <sub>2</sub> LB/mmBTU	0.193		
CO ppm, wet	17.11		
CO LB/mmBTU	0.024		
SCFH	4,857,000		
WAF applied	0.9950		

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/23-24/2013**  
**Run 4**

<b>Time</b>	<b>SO<sub>2</sub> ppm, w</b>	<b>Nox ppm, w</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>	<b>CO ppm, w</b>
22:45	73.92	55.46	9.252	9.718	17.11
22:46	73.68	55.06	9.296	9.666	17.19
22:47	74.27	54.03	9.364	9.613	16.79
22:48	72.9	53.49	9.387	9.573	18.56
22:49	69.32	53.27	9.461	9.535	16.5
22:50	67.31	52.93	9.419	9.594	16.16
22:51	68.35	52.18	9.417	9.638	18.27
22:52	43.86	61.23	9.494	9.756	18.01
22:53	16.83	67.08	9.407	9.83	18.78
22:54	12.97	67.1	9.367	9.843	17.71
22:55	13.09	66.04	9.37	9.863	17.29
22:56	17.28	61.02	9.312	9.861	19.37
22:57	42.34	55.65	9.33	9.729	17.62
22:58	59.01	54.32	9.323	9.784	18.02
22:59	68.81	54.42	9.261	9.772	16.62
23:00	77.75	53.72	9.291	9.781	15.14
23:01	85.62	53.12	9.257	9.808	16.1
23:02	89.81	53.19	9.222	9.821	16.93
23:03	90.55	52.85	9.246	9.839	14.82
23:04	92.65	51.54	9.183	9.884	14.84
23:05	86.62	49.55	9.102	9.968	16.21
<b>Average</b>	<b>61.759</b>	<b>56.060</b>	<b>9.322</b>	<b>9.756</b>	<b>17.050</b>

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/23-24/2013  
Test 2N      Run 5  
177 Klbs/Hr

#### Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta_p</u>	<u>Sq. root delta_p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.240	0.490	310	
2	A-2	0.230	0.480	310	
3	A-3	0.210	0.458	310	
4	A-4	0.220	0.469	310	
5	A-5	0.230	0.480	310	
6	A-6	0.210	0.458	310	
7	A-7	0.220	0.469	310	
8	A-8	0.220	0.469	310	
9	B-1	0.180	0.424	309	
10	B-2	0.170	0.412	309	
11	B-3	0.180	0.424	309	
12	B-4	0.200	0.447	309	
13	B-5	0.250	0.500	309	
14	B-6	0.240	0.490	309	
15	B-7	0.260	0.510	309	
16	B-8	0.270	0.520	309	11:25 PM
Average		0.221	0.469	310	
<u>Moisture Content Data</u>					
Dry Bulb (°F)		310	<u>Flow Rate Data</u>		
Wet Bulb (°F)		136.0	Static Pressure	-0.70	
TRA		1.13	Pitot Coefficient	0.831	
Vapor Pressure of Water		5.30			
ZT		173.50	Duct Width (in.)	0	
PM		345.79	Duct Length (in.)	0	
Barometric Pressure		29.29	Duct Area (ft <sup>2</sup> )	0	
Moisture Content		11.83	Stack Diameter (in.)	108	
O <sub>2</sub> %		10.425	Stack Area (ft <sup>2</sup> )	63.6172512	
CO <sub>2</sub> %		11.203			
Standard CFH		4,867,181	Molecular Weight (dry)	30.21	
K Standard CFH		81.12	Molecular Weight (wet)	28.766	
<u>Field Calculations</u>					
<u>Raw Data Table</u>					
<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O <sub>2</sub> (dry)	10.54	0.12	10.82	10.7	10.43
CO <sub>2</sub> (wet)	9.78	0.03	8.23	8.3	9.88
NOx (wet)	53.55	0.08	50.18	50.4	53.79
SO <sub>2</sub> (wet)	99.10	0.11	50.12	49.6	98.18
CO (wet)	15.33	0.10	50.54	50.80	15.34
Moisture Fuel Factor	11.83	<u>Standard CFH</u>		4,867,181	
DSCFM	1877	K Standard CFM		81.12	
<u>Results</u>					
Start Stop		11:15 PM 11:25 PM	Gases Start Gases Stop	11:15 PM 11:35 PM	
CO <sub>2</sub> %, wet		9.9			
NOX ppm, wet		53.8			
NOx LB/mmBTU		0.122			
SO <sub>2</sub> ppm, wet		98.2			
SO <sub>2</sub> LB/mmBTU		0.310			
CO ppm, wet		15.34			
CO LB/mmBTU		0.021			
SCFH		4,867,000			
WAF applied		0.9950			

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/23-24/2013**  
**Run 5**

<b>Time</b>	<b>SO<sub>2</sub> ppm, w</b>	<b>Nox ppm, w</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>	<b>CO ppm, w</b>
23:15	87.6	53.26	9.2	9.817	14.48
23:16	99.21	53.55	9.176	9.753	14.16
23:17	100.6	53.09	9.178	9.709	15.14
23:18	103.3	52.47	9.452	9.79	13.86
23:19	106.9	53.89	10.79	9.888	16.03
23:20	103.5	54.41	10.84	9.81	15.54
23:21	98.68	55.43	10.89	9.786	13.31
23:22	93.43	56.02	10.93	9.768	15.92
23:23	96.52	56.09	11	9.671	15.87
23:24	90.69	55.68	11.08	9.607	15.77
23:25	98.74	52.82	11.02	9.643	15.89
23:26	102.7	52.42	10.94	9.762	15.34
23:27	101.3	51.39	10.93	9.759	16.8
23:28	102.1	51.35	10.86	9.817	17.17
23:29	98.41	52.55	10.88	9.823	15.04
23:30	100.2	53.65	10.87	9.819	14.45
23:31	102.1	53.25	10.82	9.865	13.42
23:32	102.5	52.65	10.81	9.898	15.57
23:33	101	53.03	10.8	9.884	16.25
23:34	96.92	54.55	10.89	9.801	15.73
23:35	94.68	52.9	9.984	9.8	16.18
<b>Average</b>	<b>99.099</b>	<b>53.545</b>	<b>10.540</b>	<b>9.784</b>	<b>15.330</b>

MSI / Manitowoc PU  
 Manitowoc, WI  
 No. 9 Boiler

7/23-24/2013  
 Test 2N Run 6  
 177 Kibs/Hr

#### Volumetric Flow Rate Data

Number of Sample Points

16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.220	0.469	311	
2	A-2	0.230	0.480	311	
3	A-3	0.210	0.458	311	
4	A-4	0.220	0.469	311	
5	A-5	0.230	0.480	311	
6	A-6	0.200	0.447	311	
7	A-7	0.210	0.458	311	
8	A-8	0.200	0.447	311	
9	B-1	0.200	0.447	309	
10	B-2	0.190	0.436	309	
11	B-3	0.200	0.447	309	
12	B-4	0.230	0.480	309	
13	B-5	0.240	0.490	309	
14	B-6	0.220	0.469	309	
15	B-7	0.250	0.500	309	
16	B-8	0.240	0.490	309	11:55 PM
Average		0.218	0.467	310	
<u>Moisture Content Data</u>					
Dry Bulb (°F)		310			
Wet Bulb (°F)		136.0			
TRA		1.13			
Vapor Pressure of Water		5.30			
ZT		174.00			
PM		345.26			
Barometric Pressure		29.29			
Moisture Content		11.81			
O <sub>2</sub> %		9.226			
CO <sub>2</sub> %		11.224			
Standard CFH		4,847,223			
K Standard CFH		80.787			
<u>Flow Rate Data</u>					
Dry Bulb (°F)					-0.69
Wet Bulb (°F)					0.831
TRA					
Vapor Pressure of Water					
ZT					
PM					
Barometric Pressure					
Moisture Content					
O <sub>2</sub> %					
CO <sub>2</sub> %					
Standard CFH					
K Standard CFH					

#### Field Calculations

##### Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O <sub>2</sub> (dry)	9.37	0.07	10.85	10.7	9.23
CO <sub>2</sub> (wet)	9.81	0.03	8.23	8.3	9.90
NOx (wet)	55.00	0.07	50.02	50.4	55.43
SO <sub>2</sub> (wet)	85.65	0.10	50.55	49.6	84.12
CO (wet)	15.14	0.14	50.53	50.80	15.12
Moisture	11.81				
Fuel Factor	1877				
DSCFM	71248				
				4,847,223	
				80.787	

##### Results

Start Stop	11:45 PM	Gases Start Gases Stop	11:45 PM
CO <sub>2</sub> %, wet	9.9		
NOX ppm, wet	55.4		
NOx LB/mmBTU	0.125		
SO <sub>2</sub> ppm, wet	84.1		
SO <sub>2</sub> LB/mmBTU	0.265		
CO ppm, wet	15.12		
CO LB/mmBTU	0.021		
SCFH	4,847,000		
WAF applied	0.9950		

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/23-24/2013**  
**Run 6**

<b>Time</b>	<b>SO<sub>2</sub> ppm, w</b>	<b>Nox ppm, w</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>	<b>CO ppm, w</b>
23:45	90.09	53.33	9.401	9.862	12.13
23:46	89.91	52.71	9.381	9.858	12.28
23:47	96.1	52.03	9.342	9.908	14.29
23:48	95.52	53.53	9.3	9.911	13.86
23:49	91.56	54.56	9.232	9.942	12.45
23:50	87.51	55.48	9.27	9.926	14.03
23:51	84.12	56.48	9.282	9.949	14.68
23:52	80.83	58.4	9.262	9.947	15.83
23:53	78.94	58.03	9.333	9.861	15.53
23:54	81.28	57.86	9.359	9.842	14.11
23:55	85.29	57.52	9.416	9.795	14.87
23:56	88.91	55.71	9.482	9.776	13.55
23:57	93.68	54.4	9.414	9.788	15.03
23:58	88.91	55.22	9.455	9.778	15.3
23:59	89.4	53.5	9.432	9.791	16.15
0:00	85.47	52.25	9.374	9.878	17.67
0:01	80.62	54.72	9.3	9.891	17.67
0:02	74.46	54.65	9.396	9.827	18.2
0:03	77.74	55.05	9.413	9.806	17.07
0:04	75.81	54.55	9.416	9.797	16.64
0:05	82.57	55.07	9.411	8.863	16.5
<b>Average</b>	<b>85.653</b>	<b>55.002</b>	<b>9.365</b>	<b>9.809</b>	<b>15.135</b>

### Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.210	0.458	312	12:20 AM
2	A-2	0.200	0.447	312	
3	A-3	0.220	0.469	312	
4	A-4	0.210	0.458	312	
5	A-5	0.190	0.436	312	
6	A-6	0.210	0.458	312	
7	A-7	0.210	0.458	312	
8	A-8	0.200	0.447	312	
9	B-1	0.180	0.424	311	
10	B-2	0.190	0.436	311	
11	B-3	0.220	0.469	311	
12	B-4	0.230	0.480	311	
13	B-5	0.230	0.480	311	
14	B-6	0.250	0.500	311	
15	B-7	0.250	0.500	311	
16	B-8	0.240	0.490	311	12:30 AM
Average		0.215	0.463	312	
<b>Moisture Content Data</b>					
Dry Bulb (°F)		312	<b>Flow Rate Data</b>		
Wet Bulb (°F)		137.0	Static Pressure		-0.71
TRA		1.13	Pitot Coefficient		0.831
Vapor Pressure of Water		5.45			
ZT		174.50	Duct Width (in.)		0.00
PM		358.74	Duct Length (in.)		0.00
Barometric Pressure		29.29	Duct Area (ft <sup>2</sup> )		0.00
Moisture Content		12.27	Stack Diameter (in.)		108.00
O <sub>2</sub> %		9.084	Stack Area (ft <sup>2</sup> )		63.62
CO <sub>2</sub> %		11.479			
Standard CFH		4,808,003	Molecular Weight (dry)		30.2
K Standard CFH		80.133	Molecular Weight (wet)		28.703
<b>Field Calculations</b>					
<b>Raw Data Table</b>					
<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O <sub>2</sub> (dry)	9.21	0.05	10.84	10.7	9.08
CO <sub>2</sub> (wet)	9.98	0.04	8.23	8.3	10.07
NOx (wet)	48.43	0.09	50.09	50.4	48.73
SO <sub>2</sub> (wet)	100.13	0.12	50.41	49.6	98.65
CO (wet)	15.86	0.10	50.49	50.80	15.89
Moisture Fuel Factor	12.27	<b>Standard CFH</b>		4,808,003	
DSCFM	1877	K Standard CFM		80.133	
<b>Results</b>					
Start Stop		12:20 AM 12:30 AM	Gases Start Gases Stop	12:20 AM 12:40 AM	
CO <sub>2</sub> %, wet		10.1			
NOX ppm, wet		48.7			
NOx LB/mmBTU		0.108			
SO <sub>2</sub> ppm, wet		98.6			
SO <sub>2</sub> LB/mmBTU		0.305			
CO ppm, wet		15.89			
CO LB/mmBTU		0.022			
SCFH		4,808,000			
WAF applied		0.9950			

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/23-24/2013**  
**Run 7**

<b>Time</b>	<b>SO<sub>2</sub> ppm, w</b>	<b>Nox ppm, w</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>	<b>CO ppm, w</b>
0:20	107.4	45.42	9.113	10.01	15.45
0:21	100.3	46.53	9.169	10.01	15.83
0:22	95.09	46.58	9.224	9.983	17.62
0:23	104.7	45.04	9.168	10.02	17.64
0:24	107.4	44.79	9.158	10.03	16.64
0:25	102.3	47.11	9.096	10.1	15.6
0:26	98.6	48.38	9.05	10.11	16.2
0:27	93.74	51.26	9.095	10.02	16.32
0:28	88.55	52.01	9.309	9.861	14.84
0:29	90.68	51.18	9.354	9.875	17.04
0:30	95.42	48.39	9.361	9.878	17.43
0:31	102.5	47.64	9.312	9.917	15.56
0:32	104.7	46.67	9.31	9.881	16.61
0:33	108.9	45.47	9.255	9.993	16.89
0:34	99.5	48.59	9.25	9.98	15.86
0:35	107.1	46.2	9.158	10.16	17.35
0:36	107.3	49.66	9.087	10.02	13.6
0:37	100.2	52.41	9.131	9.948	14.15
0:38	97.2	51	9.231	9.951	13.94
0:39	95.29	51.96	9.287	9.912	14.7
0:40	95.89	50.65	9.294	9.869	13.83
<b>Average</b>	<b>100.131</b>	<b>48.426</b>	<b>9.210</b>	<b>9.978</b>	<b>15.862</b>



**MSI / Manitowoc PU**

**Manitowoc, WI**

**No. 9 Boiler**

**7/23-24/2013**

**Run 8**

<b>Time</b>	<b>SO<sub>2</sub> ppm, w</b>	<b>Nox ppm, w</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>	<b>CO ppm, w</b>
0:50	92.77	53.04	9.262	10.13	14.01
0:51	86.97	53.86	9.289	10.13	12.88
0:52	85.25	53.62	9.234	10.19	12.41
0:53	77.93	55.31	9.233	10.21	14.12
0:54	72.25	56.03	9.287	10.12	14.81
0:55	78.74	54.95	9.253	10.18	13.65
0:56	88.34	52.63	9.14	10.26	13.36
0:57	92.62	56.01	9.152	10.27	16
0:58	86.36	56.27	9.197	10.17	14.34
0:59	79.74	58.14	9.252	10.14	15.45
1:00	78.01	57.01	9.222	10.18	14.2
1:01	75.62	59.48	9.241	10.18	15.35
1:02	74.89	58.98	9.231	10.22	16.27
1:03	72.96	58.52	9.214	10.2	15.21
1:04	72.84	57.69	9.213	10.14	13.57
1:05	76.03	58.31	9.22	10.23	15.39
1:06	78.75	59.63	9.182	10.21	16.8
1:07	76.67	60.16	9.168	10.18	16.51
1:08	67.22	63.27	9.231	10.16	15.51
1:09	65.15	62.19	9.266	10.16	14.49
1:10	65.78	60.91	9.24	10.17	15.44
<b>Average</b>	<b>78.328</b>	<b>57.429</b>	<b>9.225</b>	<b>10.182</b>	<b>14.751</b>

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/23-24/2013  
Test 2N      Run 9  
177 Klbs/Hr

#### Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta_p</u>	<u>Sq. root delta_p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.220	0.469	312	
2	A-2	0.230	0.480	312	
3	A-3	0.210	0.458	312	
4	A-4	0.200	0.447	312	
5	A-5	0.190	0.436	312	
6	A-6	0.210	0.458	312	
7	A-7	0.200	0.447	312	
8	A-8	0.210	0.458	312	
9	B-1	0.230	0.480	310	
10	B-2	0.210	0.458	310	
11	B-3	0.200	0.447	310	
12	B-4	0.200	0.447	310	
13	B-5	0.240	0.490	310	
14	B-6	0.250	0.500	310	
15	B-7	0.260	0.510	310	
16	B-8	0.250	0.500	310	1:30 AM
Average		0.219	0.468	311	

#### Moisture Content Data

Dry Bulb (°F)	311	
Wet Bulb (°F)	137.0	
TRA	1.13	
Vapor Pressure of Water	5.45	
ZT	174.00	Duct Width (in.)
PM	359.28	Duct Length (in.)
Barometric Pressure	29.29	Duct Area (ft <sup>2</sup> )
Moisture Content	12.29	Stack Diameter (in.)
O <sub>2</sub> %	9.012	Stack Area (ft <sup>2</sup> )
CO <sub>2</sub> %	11.588	
Standard CFH	4,857,378	Molecular Weight (dry)
K Standard CFH	80.956	Molecular Weight (wet)
		Stack Pressure
		Feet per Second
		Actual CFM
		DSCFM

#### Field Calculations

##### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O <sub>2</sub> (dry)	9.15	0.10	10.85	10.7	9.01
CO <sub>2</sub> (wet)	10.20	0.04	8.34	8.3	10.16
NOx (wet)	66.79	0.09	50.14	50.4	67.17
SO <sub>2</sub> (wet)	76.15	0.09	50.09	49.6	75.45
CO (wet)	16.89	0.10	50.29	50.80	16.99
Moisture Fuel Factor	12.29				<u>Standard CFH</u>
DSCFM	1877				K Standard CFM
	71008				4,857,378
					80.956

##### Results

Start Stop	1:20 AM 1:30 AM	Gases Start Gases Stop	1:20 AM 1:40 AM
CO <sub>2</sub> %, wet	10.2		
NOX ppm, wet	67.2		
NOx LB/mmBTU	0.148		
SO <sub>2</sub> ppm, wet	75.4		
SO <sub>2</sub> LB/mmBTU	0.231		
CO ppm, wet	16.99		
CO LB/mmBTU	0.023		
SCFH	4,857,000		
WAF applied	0.9950		

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/23-24/2013**  
**Run 9**

<b>Time</b>	<b>SO<sub>2</sub> ppm, w</b>	<b>Nox ppm, w</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>	<b>CO ppm, w</b>
1:20	76.44	66.7	9.072	10.25	16.52
1:21	74.41	64.62	9.11	10.26	15.29
1:22	75.6	65.09	9.124	10.22	16.7
1:23	73.17	67.14	9.188	10.23	17.84
1:24	73.22	66.66	9.16	10.23	14.83
1:25	72.59	67.28	9.161	10.2	15.85
1:26	66.5	69.06	9.237	10.11	16.32
1:27	60.14	67.67	9.24	10.12	16.75
1:28	69.76	67.7	9.216	10.1	18.4
1:29	76.6	65.74	9.181	10.18	17.24
1:30	79.62	64.65	9.168	10.18	18.02
1:31	78.04	65.03	9.14	10.14	17.8
1:32	81.22	64.07	9.143	10.2	17.46
1:33	83.16	64.2	9.1	10.25	18.56
1:34	81.92	64.96	9.13	10.2	17.1
1:35	80.32	64.75	9.161	10.2	16.3
1:36	85.68	64.21	9.023	10.35	16.43
1:37	81.42	69.2	9.031	10.28	16.06
1:38	80.88	69.85	9.084	10.25	17.23
1:39	73.54	73.18	9.197	10.13	16.42
1:40	74.9	70.81	9.274	10.08	17.47
<b>Average</b>	<b>76.149</b>	<b>66.789</b>	<b>9.150</b>	<b>10.198</b>	<b>16.885</b>

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/23-24/2013  
Test 2N Run 10  
177 Kibs/Hr

#### Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta_p</u>	<u>Sq. root delta_p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.200	0.447	312	1:50 AM
2	A-2	0.200	0.447	312	
3	A-3	0.220	0.469	312	
4	A-4	0.230	0.480	312	
5	A-5	0.210	0.458	312	
6	A-6	0.190	0.436	312	
7	A-7	0.180	0.424	312	
8	A-8	0.190	0.436	312	
9	B-1	0.190	0.436	310	
10	B-2	0.200	0.447	310	
11	B-3	0.220	0.469	310	
12	B-4	0.210	0.458	310	
13	B-5	0.200	0.447	310	
14	B-6	0.250	0.500	310	
15	B-7	0.270	0.520	310	
16	B-8	0.260	0.510	310	2:00 AM
Average		0.214	0.462	311	

#### Moisture Content Data

	<u>Flow Rate Data</u>
Dry Bulb (°F)	311
Wet Bulb (°F)	136.0
TRA	1.13
Vapor Pressure of Water	5.30
ZT	175.00
PM	343.90
Barometric Pressure	29.29
Moisture Content	11.74
O <sub>2</sub> %	9.056
CO <sub>2</sub> %	11.457
Standard CFH	4,791,412
K Standard CFH	79.857
<u>Molecular Weight (dry)</u>	
<u>Molecular Weight (wet)</u>	
<u>Stack Pressure</u>	
<u>Feet per Second</u>	
<u>Actual CFM</u>	
<u>DSCFM</u>	
30.195	
28.763	
29.285	
31.212	
119139.15	
70478.9	

#### Field Calculations

##### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O <sub>2</sub> (dry)	9.19	0.07	10.85	10.7	9.06
CO <sub>2</sub> (wet)	10.13	0.03	8.32	8.3	10.11
NOx (wet)	68.24	0.14	50.13	50.4	68.66
SO <sub>2</sub> (wet)	76.57	0.10	50.15	49.6	75.78
CO (wet)	17.08	0.13	50.19	50.80	17.20
Moisture Fuel Factor	11.74			Standard CFH	4,791,412
DSCFM	1877			K Standard CFM	79.857
	70479				

##### Results

Start Stop	1:50 AM 2:00 AM	Gases Start Gases Stop	1:50 AM 2:10 AM
CO <sub>2</sub> %, wet	10.1		
NOX ppm, wet	68.7		
NOx LB/mmBTU	0.152		
SO <sub>2</sub> ppm, wet	75.8		
SO <sub>2</sub> LB/mmBTU	0.234		
CO ppm, wet	17.20		
CO LB/mmBTU	0.023		
SCFH	4,791,000		
WAF applied	0.9950		

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/23-24/2013**  
**Run 10**

<b>Time</b>	<b>SO<sub>2</sub> ppm, w</b>	<b>Nox ppm, w</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>	<b>CO ppm, w</b>
1:50	85.02	67.73	9.346	9.97	19.86
1:51	82.85	66.99	9.262	10.09	18.86
1:52	78.52	67.47	9.21	10.09	17.79
1:53	79.72	67.64	9.311	10.03	17.1
1:54	80.91	67.2	9.35	10.03	17.01
1:55	73.27	67.76	9.319	10.06	19.94
1:56	70.65	67.68	9.231	10.06	18.35
1:57	67.62	68.52	9.242	10.06	16.87
1:58	70.99	69.25	9.19	10.19	16.52
1:59	71.98	68.08	9.158	10.17	16.89
2:00	70.14	67.96	9.178	10.14	16.48
2:01	73.31	67.93	9.15	10.17	15.09
2:02	72.28	69.45	9.116	10.22	17.47
2:03	75.07	70.23	9.112	10.17	16.52
2:04	77.03	69.99	9.146	10.12	16.63
2:05	81.31	69.93	9.156	10.17	16.5
2:06	80.49	68.6	9.202	10.14	16.33
2:07	81.39	68.35	9.164	10.17	15.44
2:08	78.72	65.71	9.168	10.16	15.54
2:09	81.22	67.11	9.046	10.28	16.46
2:10	75.58	69.48	9	10.25	17.08
<b>Average</b>	<b>76.575</b>	<b>68.241</b>	<b>9.193</b>	<b>10.130</b>	<b>17.082</b>

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/24/2013  
Test 2M  
300 Kilbs/Hr

#### Volumetric Flow Rate Data

Number of Sample Points

16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.430	0.656	330	11:10 AM
2	A-2	0.410	0.640	330	
3	A-3	0.390	0.624	330	
4	A-4	0.380	0.616	330	
5	A-5	0.360	0.600	330	
6	A-6	0.380	0.616	330	
7	A-7	0.370	0.608	330	
8	A-8	0.380	0.616	330	
9	B-1	0.350	0.592	331	
10	B-2	0.340	0.583	331	
11	B-3	0.340	0.583	331	
12	B-4	0.330	0.574	331	
13	B-5	0.370	0.608	331	
14	B-6	0.410	0.640	331	
15	B-7	0.420	0.648	331	
16	B-8	0.430	0.656	331	11:16 AM
Average		0.381	0.616	331	

#### Moisture Content Data

		Flow Rate Data
Dry Bulb (°F)	330	
Wet Bulb (°F)	138.0	Static Pressure
TRA	1.12	Pitot Coefficient
Vapor Pressure of Water	5.59	
ZT	192.00	Duct Width (in.)
PM	353.21	Duct Length (in.)
Barometric Pressure	29.44	Duct Area (ft <sup>2</sup> )
Standard Meter Volume		Stack Diameter (in.)
Moisture Content	12.01	Stack Area (ft <sup>2</sup> )
O <sub>2</sub> %	5.116	Molecular Weight (dry)
CO <sub>2</sub> %	15.269	Molecular Weight (wet)
Standard CFH	6,293,844	Stack Pressure
K Standard CFH	104.897	Feet per Second
		Actual CFM
		DSCFM
		159764.28
		92299.76

#### Field Calculations

##### Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O <sub>2</sub> (dry)	5.20	0.06	10.82	10.70	5.12	dry
CO <sub>2</sub> (wet)	13.56	0.10	8.42	8.30	13.44	wet
Moisture	12.01				6,293,844	
Fuel Factor C	1840				104.897	
DSCFM	92300					

#### Results

Start Time	11:10 AM
Stop Time	11:16 AM
Standard CFH	6,294,000
CO <sub>2</sub> %, wet	13.44
WAF applied	0.9950

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/24/2013  
Test 2M  
300 KIbs/Hr  
Run 2

#### Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.350	0.592	330	11:17 AM
2	A-2	0.320	0.566	330	
3	A-3	0.310	0.557	330	
4	A-4	0.270	0.520	330	
5	A-5	0.270	0.520	330	
6	A-6	0.270	0.520	330	
7	A-7	0.280	0.529	330	
8	A-8	0.270	0.520	330	
9	B-1	0.320	0.566	331	
10	B-2	0.330	0.574	331	
11	B-3	0.360	0.600	331	
12	B-4	0.330	0.574	331	
13	B-5	0.340	0.583	331	
14	B-6	0.340	0.583	331	
15	B-7	0.360	0.600	331	
16	B-8	0.380	0.616	331	11:23 AM
Average		0.319	0.564	331	

#### Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	330	
Wet Bulb (°F)	139.0	Static Pressure
TRA	1.12	Pitot Coefficient
Vapor Pressure of Water	5.73	
ZT	191.00	Duct Width (in.)
PM	368.90	Duct Length (in.)
Barometric Pressure	29.44	Duct Area (ft <sup>2</sup> )
Standard Meter Volume		Stack Diameter (in.)
Moisture Content	12.54	Stack Area (ft <sup>2</sup> )
O <sub>2</sub> %	5.123	Molecular Weight (dry)
CO <sub>2</sub> %	15.305	Molecular Weight (wet)
Standard CFH	5,761,798	Stack Pressure
K Standard CFH	96.03	Feet per Second
		Actual CFM
		DSCFM

#### Field Calculations

##### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O <sub>2</sub> (dry)	5.20	0.04	10.82	10.70	5.12 dry
CO <sub>2</sub> (wet)	13.56	0.08	8.44	8.30	13.39 wet
Moisture Fuel Factor C	12.54				Standard CFH
	1840				K Standard CFM
	83987				5,761,798
					96.03

#### Results

Start Time	11:17 AM
Stop Time	11:23 AM
Standard CFH	5,762,000
CO <sub>2</sub> %, wet	13.39
WAF applied	0.9950

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/24/2013  
Test 2M  
300 Klbs/Hr

Run 3

### Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.350	0.592	328	11:24 AM
2	A-2	0.350	0.592	328	
3	A-3	0.340	0.583	328	
4	A-4	0.340	0.583	328	
5	A-5	0.360	0.600	328	
6	A-6	0.390	0.624	328	
7	A-7	0.400	0.632	328	
8	A-8	0.380	0.616	328	
9	B-1	0.310	0.557	329	
10	B-2	0.280	0.529	329	
11	B-3	0.260	0.510	329	
12	B-4	0.250	0.500	329	
13	B-5	0.310	0.557	329	
14	B-6	0.310	0.557	329	
15	B-7	0.320	0.566	329	
16	B-8	0.360	0.600	329	11:30 AM
Average		0.332	0.575	329	
<u>Moisture Content Data</u>					
Dry Bulb (°F)		328			
Wet Bulb (°F)		140.0			
TRA		1.12			
Vapor Pressure of Water		5.88			
ZT		188.00			
PM		387.09			
Barometric Pressure		29.44			
Standard Meter Volume					
Moisture Content		13.16			
O <sub>2</sub> %		5.123	Molecular Weight (dry)	30.671	
CO <sub>2</sub> %		15.414	Molecular Weight (wet)	29.004	
Standard CFH		5,889,763	Stack Pressure	29.413	
K Standard CFH		98.163	Feet per Second	39.067	
			Actual CFM	149121.28	
			DSCFM	85243.87	

### Field Calculations

#### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O <sub>2</sub> (dry)	5.20	0.04	10.82	10.70	5.12 dry
CO <sub>2</sub> (wet)	13.56	0.08	8.44	8.30	13.39 wet
Moisture	13.16				
Fuel Factor C	1840				
DSCFM	85244				
			Standard CFH	5,889,763	
			K Standard CFM	98.163	

### Results

Start Time	11:24 AM
Stop Time	11:30 AM
Standard CFH	5,890,000
CO <sub>2</sub> %, wet	13.39
WAF applied	0.9950

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/24/2013**  
**Run 1-3**

<b><u>Time</u></b>	<b><u>%O<sub>2</sub>, d</u></b>	<b><u>% CO<sub>2</sub>, w</u></b>
11:10	5.322	13.38
11:11	5.342	13.38
11:12	5.347	13.41
11:13	5.288	13.52
11:14	5.175	13.58
11:15	5.137	13.62
11:16	5.104	13.65
11:17	5.136	13.64
11:18	5.139	13.62
11:19	5.16	13.59
11:20	5.149	13.54
11:21	5.163	13.6
11:22	5.135	13.64
11:23	5.158	13.66
11:24	5.243	13.55
11:25	5.198	13.6
11:26	5.192	13.53
11:27	5.245	13.56
11:28	5.173	13.57
11:29	5.165	13.59
11:30	5.263	13.58
<b>Average</b>	<b>5.202</b>	<b>13.562</b>

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/24/2013  
Test 2M  
300 KIbs/Hr

### Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.320	0.566	328	11:40 AM
2	A-2	0.340	0.583	328	
3	A-3	0.360	0.600	328	
4	A-4	0.390	0.624	328	
5	A-5	0.430	0.656	328	
6	A-6	0.440	0.663	328	
7	A-7	0.440	0.663	328	
8	A-8	0.420	0.648	328	
9	B-1	0.350	0.592	329	
10	B-2	0.360	0.600	329	
11	B-3	0.370	0.608	329	
12	B-4	0.380	0.616	329	
13	B-5	0.410	0.640	329	
14	B-6	0.380	0.616	329	
15	B-7	0.390	0.624	329	
16	B-8	0.380	0.616	329	11:46 AM
Average		0.385	0.620	329	

### Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	328	
Wet Bulb (°F)	141.0	Static Pressure
TRA	1.12	Pitot Coefficient
Vapor Pressure of Water	6.04	
ZT	187.00	Duct Width (in.)
PM	403.45	Duct Length (in.)
Barometric Pressure	29.44	Duct Area (ft <sup>2</sup> )
Standard Meter Volume		Stack Diameter (in.)
Moisture Content	13.72	Stack Area (ft <sup>2</sup> )
O <sub>2</sub> %	5.13	Molecular Weight (dry)
CO <sub>2</sub> %	15.394	Molecular Weight (wet)
Standard CFH	6,358,898	Stack Pressure
K Standard CFH	105.982	Feet per Second
		Actual CFM
		DSCFM

### Field Calculations

#### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>	
O <sub>2</sub> (dry)	5.20	0.04	10.81	10.70	5.13	dry
CO <sub>2</sub> (wet)	13.39	0.06	8.39	8.30	13.28	wet
Moisture	13.72				6,358,898	
Fuel Factor C	1840				105.982	
DSCFM	91445					

### Results

Start Time	11:40 AM
Stop Time	11:46 AM
Standard CFH	6,359,000
CO <sub>2</sub> %, wet	13.28
WAF applied	0.9950

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/24/2013  
Test 2M  
300 Klbs/Hr  
Run 5

#### Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.390	0.624	332	
2	A-2	0.380	0.616	332	
3	A-3	0.430	0.656	332	
4	A-4	0.430	0.656	332	
5	A-5	0.440	0.663	332	
6	A-6	0.460	0.678	332	
7	A-7	0.470	0.686	332	
8	A-8	0.450	0.671	332	
9	B-1	0.380	0.616	331	
10	B-2	0.370	0.608	331	
11	B-3	0.380	0.616	331	
12	B-4	0.360	0.600	331	
13	B-5	0.360	0.600	331	
14	B-6	0.350	0.592	331	
15	B-7	0.380	0.616	331	
16	B-8	0.320	0.566	331	11:53 AM
Average		0.397	0.629	332	

#### Moisture Content Data

	Flow Rate Data
Dry Bulb (°F)	332
Wet Bulb (°F)	141.0
TRA	1.12
Vapor Pressure of Water	6.04
ZT	191.00
PM	399.16
Barometric Pressure	29.44
Standard Meter Volume	
Moisture Content	13.57
O <sub>2</sub> %	5.135
CO <sub>2</sub> %	15.453
Standard CFH	6,438,329
K Standard CFH	107.305
	Flow Rate Data
Static Pressure	-0.34
Pitot Coefficient	0.831
Duct Width (in.)	0
Duct Length (in.)	0
Duct Area (ft <sup>2</sup> )	0
Stack Diameter (in.)	108
Stack Area (ft <sup>2</sup> )	63.6172512
Molecular Weight (dry)	30.678
Molecular Weight (wet)	28.957
Stack Pressure	29.415
Feet per Second	42.865
Actual CFM	163618.22
DSCFM	92744.25

#### Field Calculations

##### Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O <sub>2</sub> (dry)	5.20	0.04	10.80	10.70	5.14	dry
CO <sub>2</sub> (wet)	13.39	0.03	8.33	8.30	13.36	wet
Moisture	13.57				6,438,329	
Fuel Factor C	1840				107.305	
DSCFM	92744					

#### Results

Start Time	11:47 AM
Stop Time	11:53 AM
Standard CFH	6,438,000
CO <sub>2</sub> %, wet	13.36
WAF applied	0.9950

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/24/2013  
Test 2M  
300 Klbs/Hr

### Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.410	0.640	333	
2	A-2	0.380	0.616	333	
3	A-3	0.330	0.574	333	
4	A-4	0.320	0.566	333	
5	A-5	0.320	0.566	333	
6	A-6	0.340	0.583	333	
7	A-7	0.330	0.574	333	
8	A-8	0.340	0.583	333	
9	B-1	0.380	0.616	332	
10	B-2	0.380	0.616	332	
11	B-3	0.400	0.632	332	
12	B-4	0.420	0.648	332	
13	B-5	0.420	0.648	332	
14	B-6	0.470	0.686	332	
15	B-7	0.480	0.693	332	
16	B-8	0.500	0.707	332	12:00 PM
Average		0.389	0.622	333	

### Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	333	
Wet Bulb (°F)	141.0	Static Pressure
TRA	1.12	Pitot Coefficient
Vapor Pressure of Water	6.04	
ZT	192.00	Duct Width (in.)
PM	398.09	Duct Length (in.)
Barometric Pressure	29.44	Duct Area (ft <sup>2</sup> )
Standard Meter Volume		Stack Diameter (in.)
Moisture Content	13.53	108.00
O <sub>2</sub> %	5.135	Stack Area (ft <sup>2</sup> )
CO <sub>2</sub> %	15.446	63.62
Standard CFH	6,360,305	Molecular Weight (dry)
K Standard CFH	106.005	Molecular Weight (wet)
		Stack Pressure
		Feet per Second
		Actual CFM
		161839.6
		DSCFM
		91658.91

### Field Calculations

#### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O <sub>2</sub> (dry)	5.20	0.04	10.80	10.70	5.14 dry
CO <sub>2</sub> (wet)	13.39	0.03	8.33	8.30	13.36 wet
Moisture	13.53				
Fuel Factor C	1840				
DSCFM	91659				
					6,360,305
					106.005

### Results

Start Time	11:54 AM
Stop Time	12:00 PM
Standard CFH	6,360,000
CO <sub>2</sub> %, wet	13.36
WAF applied	0.9950

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/24/2013**  
**Run 4-6**

<b>Time</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>
11:40	5.259	13.43
11:41	5.279	13.38
11:42	5.202	13.47
11:43	5.194	13.45
11:44	5.188	13.44
11:45	5.145	13.42
11:46	5.204	13.32
11:47	5.206	13.33
11:48	5.255	13.3
11:49	5.199	13.36
11:50	5.191	13.39
11:51	5.223	13.45
11:52	5.188	13.45
11:53	5.136	13.47
11:54	5.146	13.45
11:55	5.203	13.37
11:56	5.213	13.36
11:57	5.187	13.32
11:58	5.176	13.36
11:59	5.256	13.3
12:00	5.235	13.28
<b>Average</b>	<b>5.204</b>	<b>13.386</b>

### Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta_p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.420	0.648	334	
2	A-2	0.390	0.624	334	
3	A-3	0.380	0.616	334	
4	A-4	0.350	0.592	334	
5	A-5	0.340	0.583	334	
6	A-6	0.340	0.583	334	
7	A-7	0.330	0.574	334	
8	A-8	0.340	0.583	334	
9	B-1	0.390	0.624	335	
10	B-2	0.340	0.583	335	
11	B-3	0.350	0.592	335	
12	B-4	0.350	0.592	335	
13	B-5	0.410	0.640	335	
14	B-6	0.440	0.663	335	
15	B-7	0.490	0.700	335	
16	B-8	0.500	0.707	335	12:14 PM
Average		0.385	0.619	335	

### Moisture Content Data

Dry Bulb (°F)	334	<u>Flow Rate Data</u>	
Wet Bulb (°F)	140.0	Static Pressure	-0.35
TRA	1.12	Pitot Coefficient	0.831
Vapor Pressure of Water	5.88		
ZT	194.00	Duct Width (in.)	0.00
PM	380.66	Duct Length (in.)	0.00
Barometric Pressure	29.44	Duct Area (ft <sup>2</sup> )	0.00
		Stack Diameter (in.)	108.00
Standard Meter Volume		Stack Area (ft <sup>2</sup> )	63.62
Moisture Content	12.94		
O <sub>2</sub> %	5.085	Molecular Weight (dry)	30.648
CO <sub>2</sub> %	15.276	Molecular Weight (wet)	29.011
Standard CFH	6,318,523	Stack Pressure	29.414
K Standard CFH	105.309	Feet per Second	42.228
		Actual CFM	161186.2
		DSCFM	91680.53

### Field Calculations

#### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>	
O <sub>2</sub> (dry)	5.15	0.04	10.80	10.7	5.09	dry
CO <sub>2</sub> (wet)	13.33	0.02	8.33	8.3	13.30	wet
Moisture	12.94				6,318,523	
Fuel Factor C	1840				105.309	
DSCFM	91681					

### Results

Start Time	12:08 PM
Stop Time	12:14 PM
Standard CFH	6,319,000
CO <sub>2</sub> %, wet	13.30
WAF applied	0.9950

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/24/2013  
Test 2M  
Run 8  
300 Kilbs/Hr

#### Volumetric Flow Rate Data

Number of Sample Points

16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.440	0.663	335	
2	A-2	0.420	0.648	335	
3	A-3	0.370	0.608	335	
4	A-4	0.350	0.592	335	
5	A-5	0.340	0.583	335	
6	A-6	0.380	0.616	335	
7	A-7	0.370	0.608	335	
8	A-8	0.390	0.624	335	
9	B-1	0.360	0.600	336	
10	B-2	0.330	0.574	336	
11	B-3	0.340	0.583	336	
12	B-4	0.340	0.583	336	
13	B-5	0.390	0.624	336	
14	B-6	0.420	0.648	336	
15	B-7	0.490	0.700	336	
16	B-8	0.490	0.700	336	12:21 PM
Average		0.389	0.622	336	

#### Moisture Content Data

Dry Bulb (°F)  
Wet Bulb (°F)  
TRA  
Vapor Pressure of Water

335

140.0

1.12

5.88

#### Flow Rate Data

Static Pressure  
Pitot Coefficient

-0.33

0.831

ZT  
PM  
Barometric Pressure

195.00

379.57

29.44

Duct Width (in.)

0.00

Duct Length (in.)

0.00

Duct Area (ft<sup>2</sup>)

0.00

Stack Diameter (in.)

108.00

Stack Area (ft<sup>2</sup>)

63.62

Standard Meter Volume  
Moisture Content

12.90

Molecular Weight (dry)

30.647

O<sub>2</sub> %  
CO<sub>2</sub> %

5.09

Molecular Weight (wet)

29.015

15.272

Stack Pressure

29.416

Standard CFH  
K Standard CFH

6,346,681

Feet per Second

42.468

105.778

Actual CFM

162100.21

DSCFM

92128.67

#### Field Calculations

##### Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O <sub>2</sub> (dry)	5.15	0.03	10.79	10.7	5.09	dry
CO <sub>2</sub> (wet)	13.33	0.01	8.32	8.3	13.30	wet
Moisture	12.90				6,346,681	
Fuel Factor C	1840				105.778	
DSCFM	92129					

#### Results

Start Time	12:15 PM
Stop Time	12:21 PM
Standard CFH	6,347,000
CO <sub>2</sub> %, wet	13.30
WAF applied	0.9950

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/24/2013  
Test 2M Run 9  
300 KIbs/Hr

### Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.430	0.656	336	
2	A-2	0.390	0.624	336	
3	A-3	0.340	0.583	336	
4	A-4	0.330	0.574	336	
5	A-5	0.370	0.608	336	
6	A-6	0.360	0.600	336	
7	A-7	0.380	0.616	336	
8	A-8	0.380	0.616	336	
9	B-1	0.350	0.592	336	
10	B-2	0.350	0.592	336	
11	B-3	0.360	0.600	336	
12	B-4	0.340	0.583	336	
13	B-5	0.390	0.624	336	
14	B-6	0.410	0.640	336	
15	B-7	0.440	0.663	336	
16	B-8	0.490	0.700	336	12:28 PM
Average		0.382	0.617	336	

### Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	336	
Wet Bulb (°F)	140.0	Static Pressure
TRA	1.12	Pitot Coefficient
Vapor Pressure of Water	5.88	
ZT	196.00	Duct Width (in.)
PM	378.51	Duct Length (in.)
Barometric Pressure	29.44	Duct Area (ft <sup>2</sup> )
Standard Meter Volume		Stack Diameter (in.)
Moisture Content	12.87	Stack Area (ft <sup>2</sup> )
O <sub>2</sub> %	5.09	Molecular Weight (dry)
CO <sub>2</sub> %	15.266	Molecular Weight (wet)
Standard CFH	6,290,986	Stack Pressure
K Standard CFH	104.85	Feet per Second
		Actual CFM
		DSCFM
		160786.72
		91357.32

### Field Calculations

#### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>	
O <sub>2</sub> (dry)	5.15	0.03	10.79	10.7	5.09	dry
CO <sub>2</sub> (wet)	13.33	0.01	8.32	8.3	13.30	wet
Moisture	12.87				6,290,986	
Fuel Factor C	1840				104.85	
DSCFM	91357					

### Results

Start Time	12:22 PM
Stop Time	12:28 PM
Standard CFH	6,291,000
CO <sub>2</sub> %, wet	13.30
WAF applied	0.9950

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/24/2013**  
**Run 7-9**

<b>Time</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>
12:08	5.131	13.27
12:09	5.126	13.28
12:10	5.195	13.27
12:11	5.237	13.28
12:12	5.204	13.25
12:13	5.136	13.31
12:14	5.153	13.26
12:15	5.202	13.21
12:16	5.22	13.22
12:17	5.164	13.28
12:18	5.128	13.27
12:19	5.106	13.34
12:20	5.095	13.32
12:21	5.118	13.31
12:22	5.152	13.35
12:23	5.108	13.48
12:24	5.084	13.46
12:25	5.147	13.45
12:26	5.055	13.5
12:27	5.047	13.48
12:28	5.093	13.46
12:29	5.146	13.48
12:30	5.188	13.36
12:31	5.147	13.32
12:32	5.179	13.23
12:33	5.183	13.22
12:34	5.205	13.27
12:35	5.216	13.24
<b>Average</b>	<b>5.149</b>	<b>13.328</b>

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler

7/24/2013  
Test 2M Run 10  
300 Klbs/Hr

### Volumetric Flow Rate Data

Number of Sample Points **16**

<u>Point Number</u>		<u>Delta_p</u>	<u>Sq. root delta_p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.430	0.656	338	12:29 PM
2	A-2	0.390	0.624	338	
3	A-3	0.330	0.574	338	
4	A-4	0.340	0.583	338	
5	A-5	0.350	0.592	338	
6	A-6	0.360	0.600	338	
7	A-7	0.380	0.616	338	
8	A-8	0.380	0.616	338	
9	B-1	0.370	0.608	337	
10	B-2	0.340	0.583	337	
11	B-3	0.330	0.574	337	
12	B-4	0.340	0.583	337	
13	B-5	0.380	0.616	337	
14	B-6	0.430	0.656	337	
15	B-7	0.490	0.700	337	
16	B-8	0.500	0.707	337	12:35 PM
Average		0.384	0.618	338	

### Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	338	
Wet Bulb (°F)	140.0	Static Pressure -0.37
TRA	1.12	Pitot Coefficient 0.831
Vapor Pressure of Water	5.88	
ZT	198.00	Duct Width (in.) 0.00
PM	376.38	Duct Length (in.) 0.00
Barometric Pressure	29.44	Duct Area (ft <sup>2</sup> ) 0.00
Standard Meter Volume		Stack Diameter (in.) 108.00
Moisture Content	12.80	Stack Area (ft <sup>2</sup> ) 63.62
O <sub>2</sub> %	5.09	Molecular Weight (dry) 30.644
CO <sub>2</sub> %	15.253	Molecular Weight (wet) 29.026
Standard CFH	6,294,999	Stack Pressure 29.413
K Standard CFH	104.917	Feet per Second 42.232
		Actual CFM 161200.53
		DSCFM 91490.95

### Field Calculations

#### Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>	
O <sub>2</sub> (dry)	5.15	0.03	10.79	10.7	5.09	dry
CO <sub>2</sub> (wet)	13.33	0.01	8.32	8.3	13.30	wet
Moisture	12.80					
Fuel Factor C	1840					
DSCFM	91491					
					6,294,999	
					104.917	

### Results

Start Time	12:29 PM
Stop Time	12:35 PM
Standard CFH	6,295,000
CO <sub>2</sub> %, wet	13.30
WAF applied	0.9950

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/24/2013**  
**Run 10**

<b>Time</b>	<b>%O<sub>2</sub>, d</b>	<b>% CO<sub>2</sub>, w</b>
12:08	5.131	13.27
12:09	5.126	13.28
12:10	5.195	13.27
12:11	5.237	13.28
12:12	5.204	13.25
12:13	5.136	13.31
12:14	5.153	13.26
12:15	5.202	13.21
12:16	5.22	13.22
12:17	5.164	13.28
12:18	5.128	13.27
12:19	5.106	13.34
12:20	5.095	13.32
12:21	5.118	13.31
12:22	5.152	13.35
12:23	5.108	13.48
12:24	5.084	13.46
12:25	5.147	13.45
12:26	5.055	13.5
12:27	5.047	13.48
12:28	5.093	13.46
12:29	5.146	13.48
12:30	5.188	13.36
12:31	5.147	13.32
12:32	5.179	13.23
12:33	5.183	13.22
12:34	5.205	13.27
12:35	5.216	13.24
<b>Average</b>	<b>5.149</b>	<b>13.328</b>

## **APPENDIX D**

### **MEASUREMENT SYSTEMS PERFORMANCE SPECIFICATIONS**

Calibration Error

**MSI / Manitowoc PU**  
**Manitowoc, WI**  
**No. 9 Boiler**  
**7/23-24/2013**  
**Test 2N**

**S0<sub>2</sub> (TEI Model 43i)**

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
<b>Zero</b>	0.00	0.27	0.27	112.00	0.24
<b>Low Level</b>	49.60	49.37	0.23	112.00	0.21
<b>Mid Level</b>	112.00	114.10	2.10	112.00	1.88
<b>High Level</b>	255.00	259.54	4.54	255.00	1.78

**NOx (TEI Model 42i)**

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
<b>Zero</b>	0.00	0.03	0.03	113.00	0.03
<b>Mid Level</b>	50.40	50.06	0.34	113.00	0.30
<b>High Level</b>	113.00	114.00	1.00	113.00	0.88

**CO<sub>2</sub> (TEI Model 410i)**

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
<b>Zero</b>	0.00	0.03	0.03	16.73	0.18
<b>Mid Level</b>	8.30	8.31	0.01	16.73	0.06
<b>High Level</b>	16.73	16.78	0.05	16.73	0.30

**O<sub>2</sub> (Servomex Series 1400)**

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
<b>Zero</b>	0.00	0.11	0.11	21.40	0.51
<b>Mid Level</b>	10.70	10.83	0.13	21.40	0.61
<b>High Level</b>	21.40	21.14	0.26	21.40	1.21

**CO (TECO 48i)**

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
<b>Zero</b>	0.00	0.06	0.06	114.00	0.05
<b>Mid Level</b>	50.80	50.31	0.49	114.00	0.43
<b>High Level</b>	114.00	114.80	0.80	114.00	0.70

\*\*\*\* All Calibrations must be within 2% of the span value...

Calibration Drift

MSI / Manitowoc PU  
 Manitowoc, WI  
 No. 9 Boiler  
 7/23-24/2013  
 Test 2N

		$O_2$					
		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.11	0.00%	0.15	0.19%	0.13	0.19%
	Upscale	10.83	0.00%	10.84	0.05%	10.84	0.05%
2	Zero	0.15	0.19%	0.12	0.05%	0.14	-0.14%
	Upscale	10.84	0.05%	10.87	0.19%	10.86	0.14%
3	Zero	0.12	0.05%	0.16	0.23%	0.14	0.19%
	Upscale	10.87	0.19%	10.75	-0.37%	10.81	-0.56%
4	Zero	0.16	0.23%	0.15	0.19%	0.16	-0.05%
	Upscale	10.75	-0.37%	10.78	-0.23%	10.77	0.14%
5	Zero	0.15	0.19%	0.08	-0.14%	0.12	-0.33%
	Upscale	10.78	-0.23%	10.85	0.09%	10.82	0.33%
6	Zero	0.08	-0.14%	0.06	-0.23%	0.07	-0.09%
	Upscale	10.85	0.09%	10.85	0.09%	10.85	0.00%
7	Zero	0.06	-0.23%	0.03	-0.37%	0.05	-0.14%
	Upscale	10.85	0.09%	10.83	0.00%	10.84	-0.09%
8	Zero	0.03	-0.37%	0.13	0.09%	0.08	0.47%
	Upscale	10.83	0.00%	10.88	0.23%	10.86	0.23%
9	Zero	0.13	0.09%	0.06	-0.23%	0.10	-0.33%
	Upscale	10.88	0.23%	10.81	-0.09%	10.85	-0.33%
10	Zero	0.06	-0.23%	0.07	-0.19%	0.07	0.05%
	Upscale	10.81	-0.09%	10.89	0.28%	10.85	0.37%

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.11 %
Upscale	10.70 %	10.83 %
Span	21.40 %	21.40 %

\*\* All Drift Calibrations must be within 3% of the span value...

\*\* All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU  
 Manitowoc, WI  
 No. 9 Boiler  
 7/23-24/2013  
 Test 2N

CO <sub>2</sub>							
		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.03	0.00%	0.03	0.00%	0.03	0.00%
	Upscale	8.31	0.00%	8.21	-0.60%	8.26	-0.60%
2	Zero	0.03	0.00%	0.01	-0.12%	0.02	-0.12%
	Upscale	8.21	-0.60%	8.33	0.12%	8.27	0.72%
3	Zero	0.01	-0.12%	0.03	0.00%	0.02	0.12%
	Upscale	8.33	0.12%	8.24	-0.42%	8.29	-0.54%
4	Zero	0.03	0.00%	0.04	0.06%	0.04	0.06%
	Upscale	8.24	-0.42%	8.21	-0.60%	8.23	-0.18%
5	Zero	0.04	0.06%	0.01	-0.12%	0.03	-0.18%
	Upscale	8.21	-0.60%	8.24	-0.42%	8.23	0.18%
6	Zero	0.01	-0.12%	0.05	0.12%	0.03	0.24%
	Upscale	8.24	-0.42%	8.22	-0.54%	8.23	-0.12%
7	Zero	0.05	0.12%	0.03	0.00%	0.04	-0.12%
	Upscale	8.22	-0.54%	8.24	-0.42%	8.23	0.12%
8	Zero	0.03	0.00%	0.07	0.24%	0.05	0.24%
	Upscale	8.24	-0.42%	8.35	0.24%	8.30	0.66%
9	Zero	0.07	0.24%	0.01	-0.12%	0.04	-0.36%
	Upscale	8.35	0.24%	8.32	0.06%	8.34	-0.18%
10	Zero	0.01	-0.12%	0.04	0.06%	0.03	0.18%
	Upscale	8.32	0.06%	8.32	0.06%	8.32	0.00%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.03 ppm
Upscale	8.30 ppm	8.31 ppm
Span	16.73 ppm	16.73 ppm

\*\* All Drift Calibrations must be within 3% of the span value...

\*\* All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU  
 Manitowoc, WI  
 No. 9 Boiler  
 7/23-24/2013  
 Test 2N

Nox

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.03	0.00%	0.13	0.09%	0.08	0.09%
	Upscale	50.06	0.00%	49.60	-0.41%	49.83	-0.41%
2	Zero	0.13	0.09%	0.12	0.08%	0.13	-0.01%
	Upscale	49.60	-0.41%	49.57	-0.43%	49.59	-0.03%
3	Zero	0.12	0.08%	0.03	0.00%	0.08	-0.08%
	Upscale	49.57	-0.43%	49.57	-0.43%	49.57	0.00%
4	Zero	0.03	0.00%	0.09	0.05%	0.06	0.05%
	Upscale	49.57	-0.43%	50.34	0.25%	49.96	0.68%
5	Zero	0.09	0.05%	0.06	0.03%	0.08	-0.03%
	Upscale	50.34	0.25%	50.01	-0.04%	50.18	-0.29%
6	Zero	0.06	0.03%	0.07	0.04%	0.07	0.01%
	Upscale	50.01	-0.04%	50.03	-0.03%	50.02	0.02%
7	Zero	0.07	0.04%	0.11	0.07%	0.09	0.04%
	Upscale	50.03	-0.03%	50.14	0.07%	50.09	0.10%
8	Zero	0.11	0.07%	0.04	0.01%	0.08	-0.06%
	Upscale	50.14	0.07%	50.06	0.00%	50.10	-0.07%
9	Zero	0.04	0.01%	0.14	0.10%	0.09	0.09%
	Upscale	50.06	0.00%	50.21	0.13%	50.14	0.13%
10	Zero	0.14	0.10%	0.13	0.09%	0.14	-0.01%
	Upscale	50.21	0.13%	50.05	-0.01%	50.13	-0.14%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.03 ppm
Upscale	50.40 ppm	50.06 ppm
Span	113.00 ppm	113.00 ppm

\*\* All Drift Calibrations must be within 3% of the span value...  
 \*\* All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU  
 Manitowoc, WI  
 No. 9 Boiler  
 7/23-24/2013  
 Test 2N

**SO<sub>2</sub>**

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.27	0.00%	0.11	-0.14%	0.19	-0.14%
	Upscale	49.37	0.00%	50.23	0.77%	49.80	0.77%
2	Zero	0.11	-0.14%	0.05	-0.20%	0.08	-0.05%
	Upscale	50.23	0.77%	50.02	0.58%	50.13	-0.19%
3	Zero	0.05	-0.20%	0.06	-0.19%	0.06	0.01%
	Upscale	50.02	0.58%	50.55	1.05%	50.29	0.47%
4	Zero	0.06	-0.19%	0.13	-0.13%	0.10	0.06%
	Upscale	50.55	1.05%	49.99	0.55%	50.27	-0.50%
5	Zero	0.13	-0.13%	0.09	-0.16%	0.11	-0.04%
	Upscale	49.99	0.55%	50.25	0.79%	50.12	0.23%
6	Zero	0.09	-0.16%	0.11	-0.14%	0.10	0.02%
	Upscale	50.25	0.79%	50.84	1.31%	50.55	0.53%
7	Zero	0.11	-0.14%	0.13	-0.13%	0.12	0.02%
	Upscale	50.84	1.31%	49.97	0.54%	50.41	-0.78%
8	Zero	0.13	-0.13%	0.09	-0.16%	0.11	-0.04%
	Upscale	49.97	0.54%	49.93	0.50%	49.95	-0.04%
9	Zero	0.09	-0.16%	0.08	-0.17%	0.09	-0.01%
	Upscale	49.93	0.50%	50.25	0.79%	50.09	0.29%
10	Zero	0.08	-0.17%	0.11	-0.14%	0.10	0.03%
	Upscale	50.25	0.79%	50.05	0.61%	50.15	-0.18%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.27 ppm
Upscale	49.60 ppm	49.37 ppm
Span	112.00 ppm	112.00 ppm

\*\* All Drift Calibrations must be within 3% of the span value...

\*\* All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU  
 Manitowoc, WI  
 No. 9 Boiler  
 7/23-24/2013  
 Test 2N

**CO**

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.06	0.00%	0.06	0.00%	0.06	0.00%
	Upscale	50.31	0.00%	50.59	0.25%	50.45	0.25%
2	Zero	0.06	0.00%	0.09	0.03%	0.08	0.03%
	Upscale	50.59	0.25%	50.71	0.35%	50.65	0.11%
3	Zero	0.09	0.03%	0.15	0.08%	0.12	0.05%
	Upscale	50.71	0.35%	50.25	-0.05%	50.48	-0.40%
4	Zero	0.15	0.08%	0.05	-0.01%	0.10	-0.09%
	Upscale	50.25	-0.05%	50.59	0.25%	50.42	0.30%
5	Zero	0.05	-0.01%	0.14	0.07%	0.10	0.08%
	Upscale	50.59	0.25%	50.49	0.16%	50.54	-0.09%
6	Zero	0.14	0.07%	0.14	0.07%	0.14	0.00%
	Upscale	50.49	0.16%	50.56	0.22%	50.53	0.06%
7	Zero	0.14	0.07%	0.06	0.00%	0.10	-0.07%
	Upscale	50.56	0.22%	50.42	0.10%	50.49	-0.12%
8	Zero	0.06	0.00%	0.06	0.00%	0.06	0.00%
	Upscale	50.42	0.10%	50.39	0.07%	50.41	-0.03%
9	Zero	0.06	0.00%	0.14	0.07%	0.10	0.07%
	Upscale	50.39	0.07%	50.18	-0.11%	50.29	-0.18%
10	Zero	0.14	0.07%	0.12	0.05%	0.13	-0.02%
	Upscale	50.18	-0.11%	50.19	-0.11%	50.19	0.01%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.06 ppm
Upscale	50.80 ppm	50.31 ppm
Span	114.00 ppm	114.00 ppm

\*\* All Drift Calibrations must be within 3% of the span value...  
 \*\* All Bias Calibrations must be within 5% of the span value...

Interpoll Laboratories  
(763) 786-6020

Stationary Gas Turbine Nox Determination  
Method 20 NO<sub>2</sub> to NO Converter Efficiency Datasheet

Job	MSI / Manitowoc PU
Source	No. 9 Boiler
Date	7/23-24/2013
Operator	AW / NB
Analyzer	TECO Model 42i (NOx)
Analyzer S/N	510511561

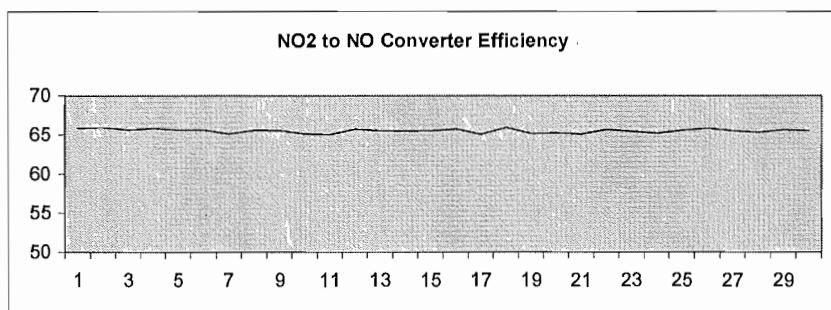
Time (min)	NOx
8:45 PM	65.88
8:46 PM	65.94
8:47 PM	65.62
8:48 PM	65.83
8:49 PM	65.61
8:50 PM	65.61
8:51 PM	65.10
8:52 PM	65.60
8:53 PM	65.55
8:54 PM	65.12
8:55 PM	65.03
8:56 PM	65.69
8:57 PM	65.52
8:58 PM	65.48
8:59 PM	65.50
9:00 PM	65.73
9:01 PM	65.07
9:02 PM	65.94
9:03 PM	65.14
9:04 PM	65.23
9:05 PM	65.05
9:06 PM	65.68
9:07 PM	65.45
9:08 PM	65.20
9:09 PM	65.57
9:10 PM	65.82
9:11 PM	65.50
9:12 PM	65.30
9:13 PM	65.61
9:14 PM	65.50

Highest Peak Value      65.94

Percent Drift      0.7%

System Pass or Fail      PASS

Instructions: Add mid-level gas to a leak-free Tedlar bag. Dilute the gas with 20.9% Oxygen to approximately 1:1. Then immediately attach the bag to the instrument and record the Nox Responses for 30 minutes. The system is OK if the response at the end is less than 2.0 % of the highest response.



## INTERPOLL LABORATORIES, INC.

(763) 786-6020

**EPA Appendix A Stratification Test**

Job:	MSI / Manitowoc PU	Date:	7/23-24/2013
Source:	No. 9 Boiler	Personnel:	AW / NB
Test	2N	Bar. Press. (in. Hg)	29.29
PDT Number	85 / 138		
Measurement Response Time:	98	seconds	

Stack Diameter		108.00	in.	Port Length	in.	11.50				
Traverse Point	Fraction of Diameter	Distance From Stack Wall (in.)		Distance From End of Port (in.)		Time (min)	SO2 ppm (wet)	NOx ppm (wet)	O2 % (dry)	CO2 % (wet)
1	0.17	18.00		29.50		21:10	52.70	59.13	9.15	10.11
2	0.50	54.00		65.50		21:17	58.85	55.82	9.35	9.92
3	0.83	90.00		101.50		21:24	55.37	55.36	9.28	9.93
Average							55.64	56.77	9.26	9.99
						Largest Value	58.85	59.13	9.35	10.11
						Smallest Value	52.70	55.36	9.15	9.92
						% Deviation	11.67%	6.80%	2.18%	1.96%

\* A three point traverse was used for each test run.

MSI / Manitowoc PU  
 Manitowoc, WI  
 No. 9 Boiler  
 7/23-24/2013  
 Stratification Test Data

<u>Time</u>	<u>SO<sub>2</sub> ppm, w</u>	<u>Nox ppm, w</u>	<u>%O<sub>2</sub>, d</u>	<u>% CO<sub>2</sub>, w</u>
21:10:00	44.70	61.82	9.13	10.16
21:11:00	46.25	61.88	9.18	10.09
21:12:00	50.44	60.40	9.11	10.16
21:13:00	54.31	59.33	9.11	10.08
21:14:00	55.60	56.86	9.13	10.14
21:15:00	58.62	57.58	9.16	10.12
21:16:00	58.97	56.03	9.21	10.02
<b>Average</b>	<b>52.70</b>	<b>59.13</b>	<b>9.15</b>	<b>10.11</b>

<u>Time</u>	<u>SO<sub>2</sub> ppm, w</u>	<u>Nox ppm, w</u>	<u>%O<sub>2</sub>, d</u>	<u>% CO<sub>2</sub>, w</u>
21:17:00	58.58	57.94	9.33	9.94
21:18:00	58.37	56.16	9.44	9.92
21:19:00	58.12	55.16	9.38	9.92
21:20:00	59.87	54.84	9.34	9.96
21:21:00	62.02	54.51	9.29	9.92
21:22:00	60.22	55.08	9.27	9.95
21:23:00	54.77	57.03	9.38	9.81
<b>Average</b>	<b>58.85</b>	<b>55.82</b>	<b>9.35</b>	<b>9.92</b>

<u>Time</u>	<u>SO<sub>2</sub> ppm, w</u>	<u>Nox ppm, w</u>	<u>%O<sub>2</sub>, d</u>	<u>% CO<sub>2</sub>, w</u>
21:24:00	46.90	54.65	9.45	9.83
21:25:00	46.24	55.86	9.37	9.88
21:26:00	37.62	60.44	9.25	10.01
21:27:00	45.95	56.41	9.19	9.98
21:28:00	63.28	53.59	9.24	9.95
21:29:00	69.54	53.43	9.26	9.91
21:30:00	78.09	53.16	9.23	9.96
<b>Average</b>	<b>55.37</b>	<b>55.36</b>	<b>9.28</b>	<b>9.93</b>

MSI / Manitowoc PU  
Manitowoc, WI  
No. 9 Boiler  
7/24/2013  
Test 2M

CO<sub>2</sub> (TEI Model 410i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.11	0.11	16.73	0.66
Mid Level	8.30	8.39	0.09	16.73	0.54
High Level	16.73	16.45	0.28	16.73	1.67

O<sub>2</sub> (Servomex Series 1400)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.07	0.07	21.40	0.33
Mid Level	10.70	10.82	0.12	21.40	0.56
High Level	21.40	21.24	0.16	21.40	0.75

\*\*\*\* All Calibrations must be within 2% of the span value...

Calibration Drift

MSI / Manitowoc PU  
 Manitowoc, WI  
 No. 9 Boiler  
 7/24/2013  
 Test 2M

		$O_2$					
		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.07	0.00%	0.04	-0.14%	<b>0.06</b>	<b>-0.14%</b>
	Upscale	10.82	0.00%	10.82	0.00%	<b>10.82</b>	<b>0.00%</b>
2	Zero	0.04	-0.14%	0.04	-0.14%	<b>0.04</b>	<b>0.00%</b>
	Upscale	10.82	0.00%	10.82	0.00%	<b>10.82</b>	<b>0.00%</b>
3	Zero	0.04	-0.14%	0.04	-0.14%	<b>0.04</b>	<b>0.00%</b>
	Upscale	10.82	0.00%	10.82	0.00%	<b>10.82</b>	<b>0.00%</b>
4	Zero	0.04	-0.14%	0.04	-0.14%	<b>0.04</b>	<b>0.00%</b>
	Upscale	10.82	0.00%	10.80	-0.09%	<b>10.81</b>	<b>-0.09%</b>
5	Zero	0.04	-0.14%	0.04	-0.14%	<b>0.04</b>	<b>0.00%</b>
	Upscale	10.80	-0.09%	10.80	-0.09%	<b>10.80</b>	<b>0.00%</b>
6	Zero	0.04	-0.14%	0.04	-0.14%	<b>0.04</b>	<b>0.00%</b>
	Upscale	10.80	-0.09%	10.80	-0.09%	<b>10.80</b>	<b>0.00%</b>
7	Zero	0.04	-0.14%	0.03	-0.19%	<b>0.04</b>	<b>-0.05%</b>
	Upscale	10.80	-0.09%	10.79	-0.14%	<b>10.80</b>	<b>-0.05%</b>
8	Zero	0.03	-0.19%	0.03	-0.19%	<b>0.03</b>	<b>0.00%</b>
	Upscale	10.79	-0.14%	10.79	-0.14%	<b>10.79</b>	<b>0.00%</b>
9	Zero	0.03	-0.19%	0.03	-0.19%	<b>0.03</b>	<b>0.00%</b>
	Upscale	10.79	-0.14%	10.79	-0.14%	<b>10.79</b>	<b>0.00%</b>
10	Zero	0.03	-0.19%	0.03	-0.19%	<b>0.03</b>	<b>0.00%</b>
	Upscale	10.79	-0.14%	10.79	-0.14%	<b>10.79</b>	<b>0.00%</b>

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.07 %
Upscale	10.70 %	10.82 %
Span	21.40 %	21.4 %

\*\* All Drift Calibrations must be within 3% of the span value...  
 \*\* All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU  
 Manitowoc, WI  
 No. 9 Boiler  
 7/24/2013  
 Test 2M

		CO <sub>2</sub>					
		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
<b>1</b>	Zero	0.11	0.00%	0.08	-0.18%	<b>0.10</b>	-0.18%
	Upscale	8.39	0.00%	8.44	0.30%	<b>8.42</b>	0.30%
<b>2</b>	Zero	0.08	-0.18%	0.08	-0.18%	<b>0.08</b>	0.00%
	Upscale	8.44	0.30%	8.44	0.30%	<b>8.44</b>	0.00%
<b>3</b>	Zero	0.08	-0.18%	0.08	-0.18%	<b>0.08</b>	0.00%
	Upscale	8.44	0.30%	8.44	0.30%	<b>8.44</b>	0.00%
<b>4</b>	Zero	0.08	-0.18%	0.03	-0.48%	<b>0.06</b>	-0.30%
	Upscale	8.44	0.30%	8.33	-0.36%	<b>8.39</b>	-0.66%
<b>5</b>	Zero	0.03	-0.48%	0.03	-0.48%	<b>0.03</b>	0.00%
	Upscale	8.33	-0.36%	8.33	-0.36%	<b>8.33</b>	0.00%
<b>6</b>	Zero	0.03	-0.48%	0.03	-0.48%	<b>0.03</b>	0.00%
	Upscale	8.33	-0.36%	8.33	-0.36%	<b>8.33</b>	0.00%
<b>7</b>	Zero	0.03	-0.48%	0.01	-0.60%	<b>0.02</b>	-0.12%
	Upscale	8.33	-0.36%	8.32	-0.42%	<b>8.33</b>	-0.06%
<b>8</b>	Zero	0.01	-0.60%	0.01	-0.60%	<b>0.01</b>	0.00%
	Upscale	8.32	-0.42%	8.32	-0.42%	<b>8.32</b>	0.00%
<b>9</b>	Zero	0.01	-0.60%	0.01	-0.60%	<b>0.01</b>	0.00%
	Upscale	8.32	-0.42%	8.32	-0.42%	<b>8.32</b>	0.00%
<b>10</b>	Zero	0.01	-0.60%	0.01	-0.60%	<b>0.01</b>	0.00%
	Upscale	8.32	-0.42%	8.32	-0.42%	<b>8.32</b>	0.00%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.11 ppm
Upscale	8.30 ppm	8.39 ppm
Span	16.73 ppm	16.73 ppm

\*\* All Drift Calibrations must be within 3% of the span value...

\*\* All Bias Calibrations must be within 5% of the span value...

**APPENDIX E**

**CALIBRATION GAS CERTIFICATION SHEETS**

THE LINDE GROUP

**CERTIFICATE OF ANALYSIS****EPA PROTOCOL MIXTURE**

PROCEDURE # : G1

**PGVP ID#:** I12012  
**CUSTOMER:** HAMMOND  
**SALES#:** 501172279  
**PROD#:** 1240925  
**P.O.# :** 4501172279  
**MATERIAL#:** 24090596  
**CERTIFICATION DATE:** 18-Dec-2012  
**EXPIRATION DATE:** 19-Dec-2020

(Using the May 2012 Revision of the EPA Protocol)

**GAS CODE:** OC2  
**CYLINDER # :** CC-131002  
**CYLINDER PRES:** 2000 PSIG  
**CYLINDER VALVE:** CGA 590  
**CYLINDER SIZE:** 2A  
**CYLINDER MATERIAL:** Aluminum  
**GAS VOLUME:** 4000 Liter  
**BLEND TOLERANCE:** 5% Relative

**PAGE:** 1 of 1**CERTIFICATION HISTORY**

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Dioxide	18-Dec-2012	16.73 %	16.73 %	+/- 1%
Oxygen	18-Dec-2012	21.4 %	21.4 %	+/- 1%

**BALANCE**

Nitrogen

**PREVIOUS CERTIFICATION DATES:** None**REFERENCE STANDARDS**

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Dioxide	NTRM-82745x	SG-9609736	19.98 %
Oxygen	NTRM-82659Y	cc-237244	24.52 %

**INSTRUMENTATION**

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Dioxide	CAI-300	S03001	NDIR	14-Dec-2012
Oxygen	CAI-300	S03001	PM	21-Nov-2012

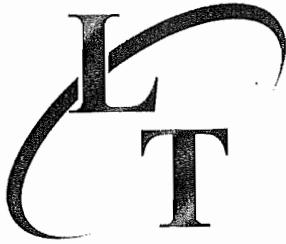
THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE 1997 EPA PROTOCOL PROCEDURES.  
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 100 PSIG.

ANALYST: MATTHEW JACKSON

Linde Gas North America LLC

DATE: 18-Dec-2012

(908) 329-9700 Main (908) 329-9740 Fax  
www.Lindeus.com



**LIQUID TECHNOLOGY CORPORATION**  
"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis  
**- EPA PROTOCOL GAS -**

Customer Minneapolis Oxygen (Minneapolis, MN)  
Date June 18, 2013  
Delivery Receipt DR-47332  
Gas Standard 8.50% CO<sub>2</sub>, 11.0% Oxygen/Nitrogen - EPA PROTOCOL  
Part Number: SPC NAE 03075  
Final Analysis Date June 17, 2013  
Expiration Date June 17, 2021

**DO NOT USE BELOW 100 psig**

Cylinder Data  
Cylinder Serial Number: EB-0019925  
Cylinder Volume: 136 Cubic Feet  
Expiration Date: June 17, 2021

Cylinder Outlet: CGA 590  
Cylinder Pressure: 1950 psig, 70°F

Analytical Data  
EPA Protocol, Section No. 2.2, Procedure G-1

**Replicate Concentrations**  
**Carbon Dioxide: 8.30% +/- 0.07%**  
**Oxygen: 10.7% +/- 0.08%**  
**Nitrogen: Balance**

Reference Standard(s):

GMIS/SRM:	GMIS/GMIS	GMIS
Cylinder Number:	EB-0026839/CC-185129	CC-231332
Concentration:	6.847% CO <sub>2</sub> /13.92% CO <sub>2</sub>	9.97% Oxygen
Expiration Date:	10/13/20 - 06/24/14	04/06/14

Certification Instrumentation

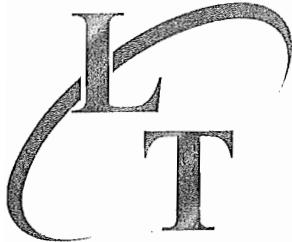
Component:	Carbon Dioxide	Oxygen
Make/Model:	Nicolet 6700	Servomex 244a
Serial Number:	APW1200289	1847
Principal of Measurement:	FTIR	Paramagnetic
Last Calibration:	May 23, 2013	May 31, 2013

Analytical uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by:

David Scott

PGVP Vendor ID: E12013



# LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

## Certificate of Analysis - EPA PROTOCOL GAS -

<u>Customer</u>	<u>Minneapolis Oxygen (Minneapolis, MN)</u>
<u>Date</u>	<u>May 13, 2013</u>
<u>Delivery Receipt</u>	<u>DR-46947</u>
<u>Gas Standard</u>	<u>112.5 ppm CO, 112.5 ppm NO, 112.5 ppm SO2/Nitrogen - EPA PROTOCOL</u>
<u>Final Analysis Date</u>	<u>May 13, 2013</u>
<u>Expiration Date</u>	<u>May 13, 2021</u>
<u>Part Number</u>	<u>SPC NAE04050</u>

**DO NOT USE BELOW 100 psig**

Analytical Data:

EPA Protocol, Section No. 2.2, Procedure G-1.

### Reported Concentrations

Carbon Monoxide: 114 ppm +/- 0.64 ppm

Nitric Oxide: 113 ppm +/- 0.40 ppm

Sulfur Dioxide: 112 ppm +/- 0.86 ppm

Nitrogen: Balance

Total NOx: 113 ppm

**\*\* NOx for Reference Use Only \*\***

Reference Standards

SRM/GMIS:	GMIS	GMIS/GMIS	GMIS/GMIS
Cylinder Number:	EB-0015851	ND-45693/ND-45515	EB-0014653/CC-251490
Concentration:	104.90 ppm CO	97.434 ppm/245.26 ppm NO	103.89 ppm SO2/507.877 ppm SO2
Expiration Date:	10/21/13	08/23/15 - 10/22/14	12/01/14 - 04/12/15

Certification Instrumentation

Component:	Carbon Monoxide	Nitric Oxide	Sulfur Dioxide
Make/Model:	NEXUS 6700	NEXUS 6700	NEXUS 6700
Serial Number:	APW1200289	APW1200289	APW1200289
Principal of Measurement:	FTIR	FTIR	FTIR
Last Calibration:	April 24, 2013	April 24, 2013	April 24, 2013

Cylinder Data

Cylinder Number:	EB-0040597	Cylinder Volume:	136 Cubic Feet
Cylinder Outlet:	CGA 660	Cylinder Pressure:	1950 psig, 70°F
Expiration Date:	May 13, 2021		

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by:

David Scott

PGVP Vendor ID: E12013

"UNMATCHED EXCELLENCE"

2048 APEX COURT APOPKA, FLORIDA 32703 ~ PHONE (407)292-2990 FAX (407)292-3313  
WWW.LIQUIDTECHCORP.COM  
APOPKA, FL • HOUSTON, TX

MPU01791



# LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

## Certificate of Analysis

### - EPA PROTOCOL GAS -

Customer

Date

Delivery Receipt

Gas Standard

Final Analysis Date

Expiration Date

Minneapolis Oxygen (Minneapolis, MN)

February 19, 2013

DR-45794

50.0 ppm CO, 50.0 ppm NO, 50.0 ppm SO<sub>2</sub>/Nitrogen - EPA PROTOCOL

February 11, 2013

February 11, 2021

## **DO NOT USE BELOW 150 psig**

### Analytical Data:

EPA Protocol, Section No. 2.2, Procedure G-1.

### Reported Concentrations

Carbon Monoxide: 50.8 ppm +/- 0.29 ppm

Nitric Oxide: 50.4 ppm +/- 0.27 ppm

Sulfur Dioxide: 49.6 ppm +/- 0.49 ppm

Nitrogen: Balance

Total NOx: 50.5 ppm

**\*\* NOx for Reference Use Only \*\***

### Reference Standards

SRM/GMIS:	GMIS	GMIS	GMIS
Cylinder Number:	CC-128982	CC-88803	EB-0014698
Concentration:	50.89 ppm CO	49.52 ppm NO	50.67 ppm SO <sub>2</sub>
Expiration Date:	10/20/14	07/18/13	09/20/14

### Certification Instrumentation

Component:	Carbon Monoxide	Nitric Oxide	Sulfur Dioxide
Make/Model:	NEXUS 6700	NEXUS 6700	NEXUS 6700
Serial Number:	AEP99000154	AEP99000154	AEP99000154
Principal of Measurement:	FTIR	FTIR	FTIR
Last Calibration:	January 30, 2013	January 30, 2013	January 30, 2013

### Cylinder Data

Cylinder Number:	CC-115901	Cylinder Volume:	133 Cubic Feet
Cylinder Outlet:	CGA 660	Cylinder Pressure:	1900 psig, 70°F
Expiration Date:	February 11, 2021		

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by:

David Scott

PGVP Vendor ID: E12013

"UNMATCHED EXCELLENCE"

2048 APEX COURT APOPKA, FLORIDA 32703 ~ PHONE (407)-292-2990 FAX (407)-292-3313

WWW.LIQUIDTECHCORP.COM



**LIQUID TECHNOLOGY CORPORATION**  
"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis

**- EPA PROTOCOL GAS -**

Customer  
Date  
Delivery Receipt  
Gas Standard  
Final Analysis Date  
Expiration Date

Minneapolis Oxygen (Minneapolis, MN)  
April 29, 2013  
DR-46677  
250 ppm CO, 250 ppm NO, 250 ppm SO<sub>2</sub>/Nitrogen - EPA PROTOCOL  
April 01, 2013  
April 01, 2021

**DO NOT USE BELOW 100 psig**

Analytical Data:

EPA Protocol, Section No. 2.2, Procedure G-1.

**Reported Concentrations**

Carbon Monoxide: 254 ppm +/- 1.0 ppm

Nitric Oxide: 249 ppm +/- 0.41 ppm

Sulfur Dioxide: 255 ppm +/- 1.0 ppm

Nitrogen: Balance

Total NOx: 249 ppm

**\*\* NOx for Reference Use Only \*\***

Reference Standards

SRM/GMIS:	GMIS	GMIS/GMIS	GMIS/GMIS
Cylinder Number:	CC-185111	ND-45693/ND-45515	EB-0014653/CC-251490
Concentration:	257.469 ppm CO	97.434 ppm/245.26 ppm NO	103.89 ppm SO <sub>2</sub> /507.877 ppm SO <sub>2</sub>
Expiration Date:	10/22/14	08/23/15 - 10/22/14	12/01/14 - 04/12/15

Certification Instrumentation

Component:	Carbon Monoxide	Nitric Oxide	Sulfur Dioxide
Make/Model:	NEXUS 6700	NEXUS 6700	NEXUS 6700
Serial Number:	APW1200289	APW1200289	APW1200289
Principal of Measurement:	FTIR	FTIR	FTIR
Last Calibration:	March 28, 2013	March 28, 2013	March 28, 2013

Cylinder Data

Cylinder Number:	EB-0033979	Cylinder Volume:	135 Cubic Feet
Cylinder Outlet:	CGA 660	Cylinder Pressure:	1925 psig, 70°F
Expiration Date:	April 01, 2021		

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by:

David Scott

PGVP Vendor ID: E1

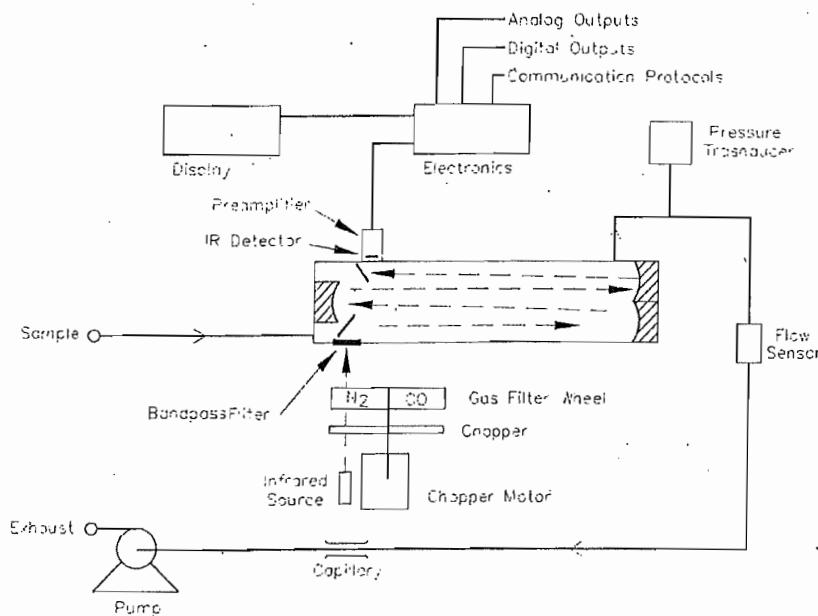
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WWW.LIQUIDTECHCORP.COM

APOPKA, FL • HOUSTON, TX

## **APPENDIX F**

### **GAS ANALYZER SPECIFICATIONS**

**Figure 1-1.** Model 48*i* Flow Schematic

## Specifications

**Table 1-1.** Model 48*i* Specifications

Preset ranges	0-1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000 (ppm or mg/m <sup>3</sup> )
Custom ranges	0-1 to 10000 (ppm or mg/m <sup>3</sup> )
Zero noise	0.02 ppm RMS (30 second averaging time)
Lower detectable limit	0.04 ppm
Zero drift (24 hour)	< 0.1 ppm
Span drift	± 1% full-scale
Response time	60 seconds (30 second averaging time)
Linearity	± 1% of full-scale ≤ 1000 ppm ± 2.5% of full-scale > 1000 ppm
Sample flow rate	1.0 LPM
Operating temperature	20-30 °C (may be safely operated over the range of 0-45 °C)*

**Introduction**  
**Specifications**

Power requirements	100 VAC @ 50/60 Hz 115 VAC @ 50/60 Hz 220–240 VAC @ 50/60 Hz 275 watts
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 49 lbs.
Analog outputs	6 voltage outputs; 0–100 mV, 1, 5, 10 V (User selectable), 5% of full-scale over/under range, 12 bit resolution, user selectable for measurement input
Digital outputs	1 power fail relay Form C, 10 digital relays Form A, user selectable alarm output, relay logic, 100 mA @ 200 VDC
Digital inputs	16 digital inputs, user select programmable, TTL level, pulled high
Serial Ports	1 RS-232 or RS-485 with two connectors, baud rate 1200–115200, data bits, parity, and stop bits, protocols: C-Link, MODBUS, and streaming data (all user selectable)
Ethernet connection	RJ45 connector for 10Mbs Ethernet connection, static or dynamic TCP/IP addressing

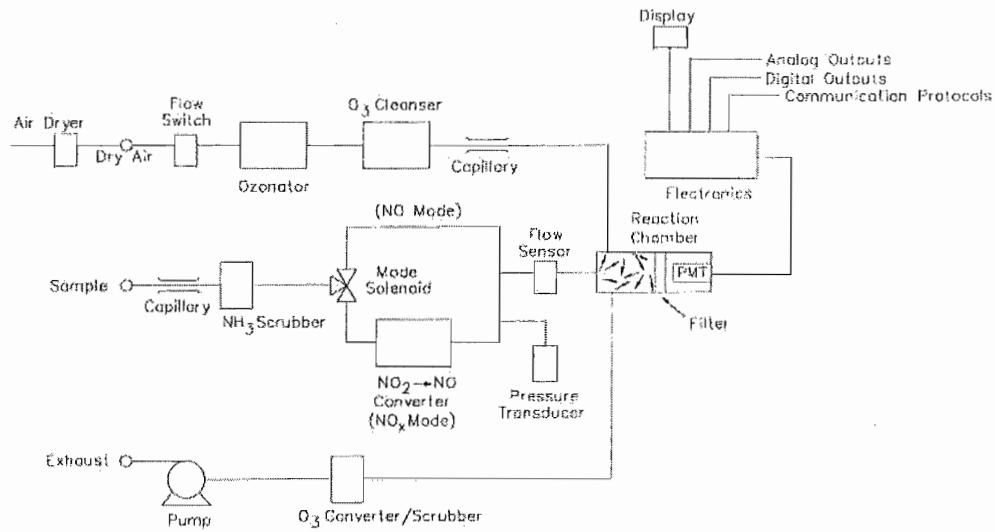
\*In non condensing environments. Performance specifications based on operation with 20–30 °C range.

## **MODEL 1420 SERVOMEX PARAMAGNETIC O<sub>2</sub> ANALYZER SPECIFICATIONS**

<b>Repeatability:</b>	Better than $\pm 0.2\%$ O <sub>2</sub> under constant conditions
<b>Drift</b>	Less than 0.2% O <sub>2</sub> per week under constant conditions. (Excluding variation due to barometric pressure changes; reading is proportional to barometric pressure)
<b>Outputs</b>	
<b>Display</b>	3 ½ digit LCD reading 0.0 to 100.0% oxygen with over range capability
<b>Output</b>	0 to 1V (non-isolated) for 0 to 100% oxygen available on 'D' type connector located on the back panel of the instrument. Output impedance is less than 10 ohms.
<b>Option</b>	4 – 20mA isolated, Max impedance 500 ohms
<b>Flow alarm output</b>	Change over relay contact rated at 3A/115V ac, 1A/240V ac or 1A/28V dc. 4 sets of single pole changeover contacts. Alarm becomes active when sample gas flow through the analyzer fails
<b>Sample Requirements</b>	
<b>Condition</b>	Clean, dry gas with dew point 5 deg C below ambient temperature
<b>Inlet pressure</b>	0.5 to 3 psig (3.5 to 21kPa). Inlet pressure changes within this range will change the reading by less than 0.1% O <sub>2</sub> . May be operated up to 10 psig (70kPa) with degraded stability
<b>Flow rate</b>	1.5 to 6 litres/minute approximately depending on sample pressure
<b>Filtering</b>	0.6 micron replaceable filter integral to the automatic flow control device.
<b>Response time</b>	Less than 15 secs. To 90% at an inlet pressure of 3 psig (21kPa)
<b>Inlet/vent connections</b>	¼ inch OD tube (stainless steel) suitable for 6mm ID flexible tubing or ¼ inch OD compression fittings.

<b>Materials exposed to the sample</b>	Stainless steel, Pyrex glass, brass, platinum, epoxy resin, viton, polypropylene and glass fibre filter
<b><u>Physical Characteristics</u></b>	
<b>Case</b>	Steel and aluminum finished in epoxy powder paint
<b>Case Classification</b>	IP 20 (IEC 529) when fitted into the Servomex 1400 series 19 inch case
<b>Weight</b>	10Kg (22 lb) approximately
<b><u>Electrical</u></b>	
<b>AC Supply</b>	110 to 120V AC or 220 to 240V AC, ±10%, 48 to 62Hz. Voltage selected by a voltage selector integral to the IEC supply plug
<b>Power required</b>	15VA maximum

NO<sub>2</sub>, and NO<sub>x</sub> concentrations to the front panel display, the analog outputs, and also makes the data available over the serial or ethernet connection.



**Figure 1-1.** Model 42*i* Low Source Flow Schematic

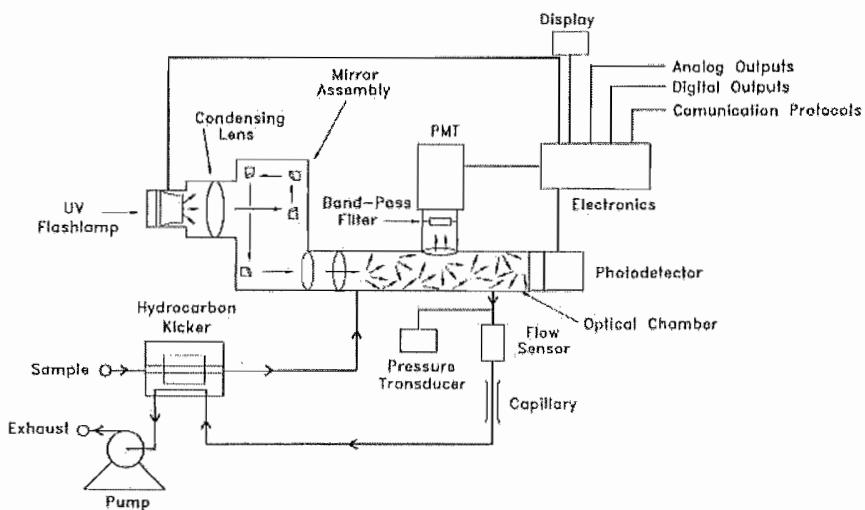
## Specifications

**Table 1-1.** Model 42*i* Low Source Specifications

Preset ranges	0-0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 ppm 0-0.5, 1, 2, 5, 10, 20, 50, 100, 150 mg/m <sup>3</sup>
Extended ranges	0-1, 2, 5, 10, 20, 50, 100, 200, 500 ppm 0-2, 5, 10, 20, 50, 100, 200, 500, 750 mg/m <sup>3</sup>
Custom ranges	0-0.2 to 100 ppm (0-1 to 500 ppm in extended ranges) 0-0.5 to 150 mg/m <sup>3</sup> (0-2 to 750 mg/m <sup>3</sup> in extended ranges)
Zero noise	0.005 ppm RMS (60 second averaging time)
Lower detectable limit	0.01 ppm (60 second averaging time)
Zero drift (24 hour)	≈ 0.005 ppm
Span drift (24 hour)	± 1% full-scale
Response time (NO/NO <sub>x</sub> mode)	15 sec (10 second averaging time) 85 sec (60 second averaging time) 305 sec (300 second averaging time)

Response time (NO mode)	15 sec (10 second averaging time) 65 sec (60 second averaging time) 305 sec (300 second averaging time)
Linearity	± 1% full-scale
Sample flow rate	≈ 25 cc/min. measured at atmospheric pressure
Operating temperature	15–35 °C (may be safely operated over the range of 0–45 °C)*
Power requirements	100 VAC @ 50/60 Hz 115 VAC @ 50/60 Hz 220–240 VAC @ 50/60 Hz 300 watts
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 55 lbs.
Analog outputs	6 voltage outputs; 0–100 mV, 1 V, 5 V, 10 V (User selectable), 5% of full-scale over/under range, 12 bit resolution, user selectable for measurement input
Digital outputs	1 power fail relay Form C, 10 digital relays Form A, user selectable alarm output, relay logic, 100 mA @ 200 VDC
Digital inputs	16 digital inputs, user select programmable, TTL level, pulled high
Serial Ports	1 RS-232 or RS-485 with two connectors, baud rate 1200–115200, data bits, parity, and stop bits, protocols: C-Link, MODBUS, and streaming data (all user selectable)
Ethernet connection	RJ45 connector for 10Mbs Ethernet connection, static or dynamic TCP/IP addressing

\*In non condensing environments. Performance specifications based on operation in 15–35 °C range.

**Figure 1-1.** Model 43*i* Flow Schematic

## Specifications

**Table 1-1.** Model 43*i* Specifications

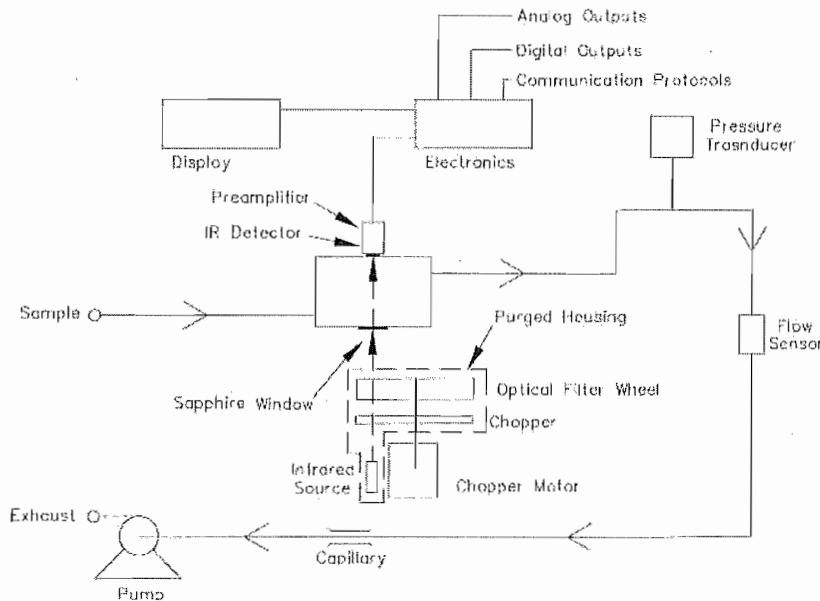
Preset ranges	0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 ppm 0.2, 0.5, 1, 2, 5, 10, 20, 25 mg/m <sup>3</sup>
Extended ranges	0.05, 1, 2, 5, 10, 20, 50, 100 ppm 0.2, 5, 10, 20, 50, 100, 200, 250 mg/m <sup>3</sup>
Custom ranges	0.05 to 10 ppm (0.5 to 100 ppm in extended range) 0.2 to 25 mg/m <sup>3</sup> (0.2 to 250 mg/m <sup>3</sup> in extended range)
Zero noise	1.0 ppb RMS (10 second averaging time) 0.5 ppb RMS (60 second averaging time) 0.25 ppb RMS (300 second averaging time)
Lower detectable limit	2.0 ppb (10 second averaging time) 1.0 ppb (60 second averaging time) 0.5 ppb (300 second averaging time)
Zero drift (24 hour)	< 1 ppb
Span drift	± 1% full-scale
Response time (in automatic mode)	80 sec (10 second averaging time) 110 sec (60 second averaging time) 320 sec (300 second averaging time)
Linearity	± 1% of full-scale

Sample flow rate	0.5 LPM (standard) 1 LPM (optional)
Interferences (tested at levels specified by EPA)	less than lower detectable limit except for the following: NO: < 3 ppb, tested at 500 ppb M-Xylene: tested at 200 ppb H <sub>2</sub> O: tested at 2% of reading
Operating temperature	20–30 °C (may be safely operated over the range of 0–45 °C)*
Power requirements	100 VAC @ 50/60 Hz 115 VAC @ 50/60 Hz 220-240 VAC @ 50/60 Hz 165 watts
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 48 lbs.
Analog outputs	6 voltage outputs; 0–100 mV, 1, 5, 10 V (user selectable), 5% of full-scale over/under range, 12 bit resolution, user selectable for measurement input
Digital outputs	1 power fail relay Form C, 10 digital relays Form A, user selectable alarm output, relay logic, 100 mA @ 200 VDC
Digital inputs	16 digital inputs, user select programmable, TTL level, pulled high
Serial Ports	1 RS-232 or RS-485 with two connectors, baud rate 1200–115200, data bits, parity, and stop bits, protocols: C-Link, MODBUS, and streaming data (all user selectable)
Ethernet connection	RJ45 connector for 10Mbs Ethernet connection, static or dynamic TCP/IP addressing

\*In non condensing environments. Performance specifications based on operation within 20–30 °C range.

**Table 1-2. Model 43*i* Optional Permeation Oven Specifications**

Temperature control	Single Point 45 °C
Temperature stability	± 0.1 °C
Warm-up time	1 hour (permeation device can take 24 to 48 hours to stabilize)
Carrier gas flow	≈ 70 scc/min
Chamber size	Accepts permeation tubes up to 9 cm in total length; 1 cm in diameter
Temperature range	20–30 °C
Physical dimensions	Contained inside the Model 43 <i>i</i>
Power requirements	120 VAC @ 50/60 Hz, 50 watts (in addition to the standard Model 43 <i>i</i> )
Weight	Approximately 5 lbs. (in addition to the standard Model 43 <i>i</i> )



**Figure 1-1.** Model 410*i* Flow Schematic

## Specifications

**Table 1-1.** Model 410*i* Specifications

$\text{CO}_2$	
Preset ranges	Standard: 0-200, 500, 1000, 2000, 5000, 10000 ppm High Level: 0-0.5, 1, 2, 5, 10, 20, 25%
Custom ranges	Standard: 0-200 to 10000 ppm High Level: 0-0.5 to 25%
Zero noise	Standard: 0.5 ppm RMS (60 second averaging time) High Level: 20 ppm RMS (60 second averaging time)
Minimum detectable limit	Standard: 1 ppm High Level: 40 ppm
Zero drift (24 hour)	$\pm 1.0$ ppm
Span drift (24 hour)	$\pm 2\%$ span concentration
Response time	90 seconds (30 second averaging time)
Linearity	$\pm 1.5\%$ of span (at concentrations of 10 to 100% of span)
Sample flow rate	1.0 LPM
Operating temperature	5-45 °C

Power requirements	100 VAC @ 50/60 Hz 115 VAC @ 50/60 Hz 220–240 VAC @ 50/60 Hz 275 watts
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 39 lbs.
Analog outputs	6 voltage outputs; 0–100 mV, 1, 5, 10 V (User selectable), 5% of full-scale over/under range, 12 bit resolution, user selectable for measurement input
Digital outputs	1 power fail relay Form C, 10 digital relays Form A, user selectable alarm output, relay logic, 100 mA @ 200 VDC
Digital inputs	16 digital inputs, user select programmable, TTL level, pulled high
Serial Ports	1 RS-232 or RS-485 with two connectors, baud rate 1200–115200, Protocols: C-Link, MODBUS, and streaming data (all user selectable)
Ethernet connection	RJ45 connector for 10Mbs Ethernet connection, static or dynamic TCP/IP addressing

## **APPENDIX G**

### **CEM INSTRUMENT INFORMATION SHEET**

**CEM Relative Accuracy Certification Instrument Information Sheet**

Plant Name:	<u>MPCA</u>		Plant Location:	<u>UNIT 9</u>	
Pollutant Gas Monitor Data:			Diluent Monitor Data:	<u>SEE SO<sub>2</sub> FORM</u>	
Vendor:	<u>Thermo Environmental</u>		Vendor:		
Model:	<u>42 INOX SIN 42I 0510511561</u>		Model:		
CEM Location:	<u>B9 S4 ECTER</u>		CEM Location:		
Gas (es):	<input type="checkbox"/> SO <sub>2</sub>	<input checked="" type="checkbox"/> NO <sub>x</sub>	Gas:	<input type="checkbox"/> O <sub>2</sub>	<input type="checkbox"/> CO <sub>2</sub>
Type of System:	<input type="checkbox"/> In-Situ	<input type="checkbox"/> Dry-Extractive	Type of System:	<input type="checkbox"/> In-Situ	<input type="checkbox"/> Dry-Extractive
Installation Date:	<u>8-15-2005</u>		Installation Date:		
Start-Up Date:	<u>1-1-2006</u>		Start-Up Date:		
Data Recording System:	<input checked="" type="checkbox"/> Data Logger System		Data Recording System:	<input type="checkbox"/> Data Logger System	
	<input type="checkbox"/> Strip Chart Recorder	<input type="checkbox"/> Computer		<input type="checkbox"/> Strip Chart Recorder	<input type="checkbox"/> Computer
Relative Accuracy Certification Units:			Output Units:		
<input type="checkbox"/> ppm, dry	<input type="checkbox"/> LB/106BTU by O <sub>2</sub> F-Factor	<input type="checkbox"/> % O <sub>2</sub> , dry	<input type="checkbox"/> % CO <sub>2</sub> , dry		
<input checked="" type="checkbox"/> ppm, wet	<input checked="" type="checkbox"/> LB/106BTU by CO <sub>2</sub> F-Factor	<input type="checkbox"/> % O <sub>2</sub> , wet	<input type="checkbox"/> % CO <sub>2</sub> , wet		
Span Value (ppm) / Range:			Span Gas Values (% v/v):		
SO <sub>2</sub>			*****Oxygen*****	***Carbon Dioxide***	
NOx	<u>Low: 2.00 High: 500</u>		Low		
CO			High		
<u>John Rad</u>					
Date <u>10-07-07</u>					
Signature of Person Responsible for Data					

**CEM Relative Accuracy Certification Instrument Information Sheet**

Plant Name:	<u>MANTO ABC PUBLIC ATTIC MIES-MPA</u>		Plant Location:	<u>UNIT 9</u>
Pollutant Gas Monitor Data:				
Vendor:	<u>THEMO ENVIRONMENTAL</u>		Diluent Monitor Data:	
Model:	<u>4315 SO<sub>2</sub></u>	S/N <u>4310510511567</u>	Vendor:	<u>THEMO ENVIRONMENTAL</u>
CEM Location:	<u>B9 S HECTER</u>	S/N <u>41010510511589</u>	Model:	<u>410 F CO<sub>2</sub></u>
Gas (es):	<input checked="" type="checkbox"/> SO <sub>2</sub>	<input type="checkbox"/> NOx	CEM Location:	<u>B9 SH/ECTER</u>
Type of System:	<input type="checkbox"/> In-Situ	<input type="checkbox"/> Dry-Extractive	Gas:	<input type="checkbox"/> O <sub>2</sub>
Installation Date:	<u>8-15-2005</u>		Type of System:	<input type="checkbox"/> In-Situ <input checked="" type="checkbox"/> Dry-Extractive <input checked="" type="checkbox"/> Dilution
Start-Up Date:	<u>1-1-2006</u>		Instillation Date:	<u>8-15-2005</u>
Start-Up Date:	<u>1-1-2006</u>		Start-Up Date:	<u>1-1-2006</u>
Start-Up Date:	<u>03-07-2006</u>		Start-Up Date:	<u>03-07-2006</u>
Data Recording System:				
<input checked="" type="checkbox"/> Data Logger System				
<input type="checkbox"/> Strip Chart Recorder				
<input checked="" type="checkbox"/> Computer				
Data Recording System:				
<input checked="" type="checkbox"/> Data Logger System				
<input type="checkbox"/> Strip Chart Recorder				
<input checked="" type="checkbox"/> Computer				
Relative Accuracy Certification Units:				
<input type="checkbox"/> ppm, dry				
<input checked="" type="checkbox"/> ppm, wet				
<input type="checkbox"/> LB/106BTU by O <sub>2</sub> F-Factor				
<input checked="" type="checkbox"/> LB/106BTU by CO <sub>2</sub> F-Factor				
Span Value (ppm):	<u>(Duct Raw GE)</u>		Span Gas Values (% v/v):	<u>***Carbon Dioxide***</u>
SO <sub>2</sub>	<u>Low: 400</u>	<u>Hgt: 4000</u>	Low	<u>0</u>
NOx			High	<u>20.00</u>
CO				

Date

*Barry Reed*

Signature of Person Responsible for Data

INTERPOLL LABORATORIES, INC.  
(763) 786-6020

**Flow Monitor Relative Field Accuracy Instrument Information Sheet**

Plant Name:	MPA		
Plant Location:	CENIT 9		
Flow Monitor Data:			
Vendor:	UNITED SCAFFLES, INC	Diluent Monitor Data:	
Model:	ACTA FLOW 150 SIN 1500188	Vendor:	
Location:	B9 SPECTER # BREAST # 106	Model:	S/N _____
Type of System:	<input checked="" type="checkbox"/> Differential Pressure <input checked="" type="checkbox"/> Ultrasonic	Location:	
Installation Date:	8-15-2005	Gas:	<input type="checkbox"/> O <sub>2</sub> <input type="checkbox"/> CO <sub>2</sub> <input type="checkbox"/> In-Situ <input type="checkbox"/> Dry-Extractive
Start-Up Date:	1-1-2006	Type of System:	<input type="checkbox"/> Extractive - Dilution
Zonitac	CERT: 02-23-2006	Instillation Date:	
Data Recording System:			
<input type="checkbox"/> Strip Chart Recorder	<input checked="" type="checkbox"/> Data Logger System	Data Recording System:	<input type="checkbox"/> Data Logger System
<input checked="" type="checkbox"/> Computer		<input type="checkbox"/> Strip Chart Recorder	<input type="checkbox"/> Computer
Output Units:			
	<input type="checkbox"/> %O <sub>2</sub> , dry	<input type="checkbox"/> %CO <sub>2</sub> , dry	
	<input type="checkbox"/> %O <sub>2</sub> , wet	<input type="checkbox"/> %CO <sub>2</sub> , wet	
Span Gas Values (% v/v):			
*****Oxygen*****			
***Carbon Dioxide***			
Low			
High	10-17-07		

### CEM Relative Accuracy Certification Instrument Information Sheet

Plant Name:	Minneapolis Public Utilities			Plant Location:			
<b>Pollutant Gas Monitor Data:</b>				<b>Diluent Monitor Data:</b>			
Vendor:	Thermo Enviro Mewtal			Vendor:			
Model:	48i S/N 4816510547			Model:			
Location:	B9			Location:			
Gas (es):	<input type="checkbox"/> SO <sub>2</sub>	<input type="checkbox"/> NOx	<input checked="" type="checkbox"/> CO	Gas:	<input type="checkbox"/> O <sub>2</sub>	<input type="checkbox"/> CO <sub>2</sub>	
Type of System:	<input type="checkbox"/> In-Situ	<input type="checkbox"/> Extractive	<input checked="" type="checkbox"/> Dilution	Type of System:	<input type="checkbox"/> In-Situ	<input type="checkbox"/> Extractive	<input type="checkbox"/> Dilution
Probe Manufacturer:	EPM			Installation Date:			
Installation Date:	4 AUG 05			Start-Up Date:			
Start-Up Date:	4 AUG 05						
<b>Data Recording System:</b>	<input checked="" type="checkbox"/> Data Logger System <input type="checkbox"/> Strip Chart Recorder <input type="checkbox"/> Computer			<b>Data Recording System:</b>	<input type="checkbox"/> Data Logger System <input type="checkbox"/> Strip Chart Recorder <input type="checkbox"/> Computer		
<b>Relative Accuracy Certification Units:</b>	<input type="checkbox"/> ppm, dry <input checked="" type="checkbox"/> ppm, wet			<b>Output Units:</b>	<input type="checkbox"/> %CO <sub>2</sub> , dry <input type="checkbox"/> %O <sub>2</sub> , dry <input type="checkbox"/> %CO <sub>2</sub> , wet <input type="checkbox"/> %O <sub>2</sub> , wet		
<b>Span Value (ppm):</b>				<b>Span Gas Values (% v/v):</b>	****Carbon Dioxide**** *****Oxygen***** Low _____ High _____		
SO <sub>2</sub>							
NOx							
CO	100 / 5000						
				Date			
 Signature of Person Responsible for Data							

## **APPENDIX H**

### **CEM COMPUTER PRINTOUTS**

## RATA Test - Part 75

Plant: MPU Source: B9

Parameter: B9CPCO2

Effective Date/Time: 07/24/2013 03:10

Monitoring System ID: X09

Test Reason: QA-Periodic Quality Assurance

Overall RA: 1.67

CEMS Time Offset :

Test Comment:

Unit of Measure: PERCENT  
Test Number: XML (X09-Q3-2013-002) / EDR (1)  
Frequency: 4Q TRS  
Test Result: Passed  
Overall BAF: 1.000

	Operating Level: Low	Level BAF: 1.000	APS Indicator: False	Report in EDR: Y
	Mean CEMS: 10.089	Relative Accuracy: 1.67	tValue: 2.306	Use BAF: Y
	Mean Reference: 9.989	Standard Deviation: 0.087	Avg Load: 180	Reference Method: 3A
	Mean Difference: -0.100	Confidence Coefficient: 0.067		

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	07/23/2013 21:15	07/23/2013 21:35	10.0	10.2	-0.2	180	Y
	07/23/2013 21:45	07/23/2013 22:05	9.9	10.1	-0.2	179	Y
	07/23/2013 22:15	07/23/2013 22:35	9.9	10.1	-0.2	181	Y
	07/23/2013 22:45	07/23/2013 23:05	9.9	10.0	-0.1	179	Y
	07/23/2013 23:15	07/23/2013 23:35	9.9	10.0	-0.1	180	Y
	07/23/2013 23:45	07/24/2013 00:05	9.9	10.0	-0.1	180	Y
	07/24/2013 00:20	07/24/2013 00:40	10.1	10.1	0.0	182	Y
	07/24/2013 00:50	07/24/2013 01:10	10.2	10.1	0.1	180	
	07/24/2013 01:20	07/24/2013 01:40	10.2	10.2	0.0	181	Y
	07/24/2013 01:50	07/24/2013 02:10	10.1	10.1	0.0	181	

## RATA Test - Part 75

Plant: MPU Source: B9

Parameter: B9CPFLOW

Effective Date/Time: 07/24/2013 02:59

Monitoring System ID: X03

Test Reason: QA-Periodic Quality Assurance

Overall RA: 1.35

CEMS Time Offset :

Test Comment:

Unit of Measure: SCFH

Test Number: XML (X03-Q3-2013-002) / EDR (1)

Frequency: 4QTRS

Test Result: Passed

Overall BAF: 1.000

Operating Level: Low	Level BAF: 1.000	APS Indicator: False	Report in EDR: Y			
Mean CEMS: 4,807,555.556	Relative Accuracy: 1.35	tValue: 2.306	Use BAF: Y			
Mean Reference: 4,836,444.444	Standard Deviation: 47,332.453	Avg Load: 180	Reference Method: 2			
Mean Difference: 28,888.889	Confidence Coefficient: 36,382.879					
Flow/Load Ratio: 0.27	CO/O2 RM Used:	Stack Dia:	Default WAF:			
Heat/Load Ratio: 1478	Reference Heat:	Stack Area:	Calculated WAF:			
Run	Started	Ended	CEMS Value	Difference	Load	Use
1	07/23/2013 21:15	07/23/2013 21:24	4,907,000.0	4,824,000.0	83,000.0	180
2	07/23/2013 21:45	07/23/2013 21:54	4,861,000.0	4,811,000.0	50,000.0	178
3	07/23/2013 22:15	07/23/2013 22:24	4,894,000.0	4,822,000.0	72,000.0	181
4	07/23/2013 22:45	07/23/2013 22:54	4,857,000.0	4,811,000.0	46,000.0	178
5	07/23/2013 23:15	07/23/2013 23:24	4,867,000.0	4,789,000.0	78,000.0	180
6	07/23/2013 23:45	07/23/2013 23:54	4,847,000.0	4,807,000.0	40,000.0	181
7	07/24/2013 00:20	07/24/2013 00:29	4,808,000.0	4,818,000.0	-10,000.0	182
8	07/24/2013 00:50	07/24/2013 00:59	4,746,000.0	4,805,000.0	-59,000.0	180
9	07/24/2013 01:20	07/24/2013 01:29	4,857,000.0	4,794,000.0	63,000.0	181
10	07/24/2013 01:50	07/24/2013 01:59	4,791,000.0	4,811,000.0	-20,000.0	180

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MPU01812

## RATA Test - Part 75

Plant: MPU Source: B9

Parameter: B9CPNOX

Effective Date/Time: 07/24/2013 03:10

Monitoring System ID: X06

Test Reason: QA-Periodic Quality Assurance

Overall RA: 3.69

CEMS Time Offset :

Test Comment:

Unit of Measure: PPM

Test Number: XML (X06-Q3-2013-002) / EDR (1)

Frequency: 4QTRS

Test Result: Passed

Overall BAF: 1.025

Operating Level:	Low	Level BAF:	1.025
Mean CEMS:	56.033	Relative Accuracy:	3.69
Mean Reference:	57.444	Standard Deviation:	0.925
Mean Difference:	1.411	Confidence Coefficient:	0.711

APS Indicator:	False
tValue:	2.306
Avg Load:	180

Report in EDR: Y  
Use BAF: Y  
Reference Method: 7E

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	07/23/2013 21:15	07/23/2013 21:35	57.4	54.7	2.7	180	
2	07/23/2013 21:45	07/23/2013 22:05	58.7	57.5	1.2	179	Y
3	07/23/2013 22:15	07/23/2013 22:35	50.1	49.9	0.2	181	Y
4	07/23/2013 22:45	07/23/2013 23:05	56.6	56.9	-0.3	179	Y
5	07/23/2013 23:15	07/23/2013 23:35	53.8	52.4	1.4	180	Y
6	07/23/2013 23:45	07/24/2013 00:05	55.4	53.7	1.7	180	Y
7	07/24/2013 00:20	07/24/2013 00:40	48.7	47.0	1.7	182	Y
8	07/24/2013 00:50	07/24/2013 01:10	57.8	55.7	2.1	180	Y
9	07/24/2013 01:20	07/24/2013 01:40	67.2	64.8	2.4	181	Y
10	07/24/2013 01:50	07/24/2013 02:10	68.7	66.4	2.3	181	Y

## RATA Test - Part 75

Plant: MPU Source: B9

Parameter:	B9CPSO2	Unit of Measure:	PPM
Effective Date/Time:	07/24/2013 03:10	Test Number:	XML (X01-Q3-2013-002) / EDR (1)
Monitoring System ID:	X01	Frequency:	4QTRS
Test Reason:	QA-Periodic Quality Assurance	Test Result:	Passed
Overall RA:	6.13	Overall BAF:	1.041
CEMS Time Offset :			
Test Comment:			

Operating Level: Low				Level BAF: 1.041	APS Indicator: False	Report in EDR: Y	
Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	07/23/2013 21:15	07/23/2013 21:35	54.4	59.2	-4.8	180	
2	07/23/2013 21:45	07/23/2013 22:05	74.2	71.7	2.5	179	Y
3	07/23/2013 22:15	07/23/2013 22:35	82.0	82.6	-0.6	181	Y
4	07/23/2013 22:45	07/23/2013 23:05	61.0	57.9	3.1	179	Y
5	07/23/2013 23:15	07/23/2013 23:35	98.2	91.1	7.1	180	Y
6	07/23/2013 23:45	07/24/2013 00:05	84.1	79.7	4.4	180	Y
7	07/24/2013 00:20	07/24/2013 00:40	98.6	95.5	3.1	182	Y
8	07/24/2013 00:50	07/24/2013 01:10	77.8	77.2	0.6	180	Y
9	07/24/2013 01:20	07/24/2013 01:40	75.4	71.2	4.2	181	Y
10	07/24/2013 01:50	07/24/2013 02:10	75.8	71.3	4.5	181	Y

## RATA Test - Part 75

Plant: MPU   Source: B9

Parameter: B9NOX#M

Effective Date/Time: 07/24/2013 03:10

Monitoring System ID: X05

Test Reason: QA-Periodic Quality Assurance

Overall RA: 5.70

CEMS Time Offset :

Test Comment:

Unit of Measure: #MMBTU

Test Number: XML (X05-Q3-2013-002) / EDR (1)

Frequency: 4QTRS

Test Result: Passed

Overall BAF: 1.048

Operating Level: Low	Level BAF: 1.048
Mean CEMS: 0.122	Relative Accuracy: 5.70
Mean Reference: 0.127	Standard Deviation: 0.002
Mean Difference: 0.006	Confidence Coefficient: 0.001

APS Indicator: False	Report in EDR: Y
tValue: 2.306	Use BAF: Y
Avg Load: 180	Reference Method:

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	07/23/2013 21:15	07/23/2013 21:35	0.126	0.118	0.008	180	Y
2	07/23/2013 21:45	07/23/2013 22:05	0.130	0.124	0.006	179	Y
3	07/23/2013 22:15	07/23/2013 22:35	0.112	0.108	0.004	181	Y
4	07/23/2013 22:45	07/23/2013 23:05	0.126	0.124	0.002	179	Y
5	07/23/2013 23:15	07/23/2013 23:35	0.120	0.114	0.006	180	Y
6	07/23/2013 23:45	07/24/2013 00:05	0.125	0.117	0.008	180	
7	07/24/2013 00:20	07/24/2013 00:40	0.108	0.102	0.006	182	Y
8	07/24/2013 00:50	07/24/2013 01:10	0.127	0.120	0.007	180	Y
9	07/24/2013 01:20	07/24/2013 01:40	0.148	0.140	0.008	181	Y
10	07/24/2013 01:50	07/24/2013 02:10	0.149	0.144	0.005	181	Y

## RATA Test - Permit

Plant: MPU   Source: B9

Parameter: B9CO#M

Effective Date/Time: 07/24/2013 03:10

Test Result: Passed

Overall RA: 15.38

CEMS Time Offset :

Test Comment:

RA Calc Method: Standard Equation

Operating Level: Low  
 Mean CEMS: 0.021  
 Mean Reference: 0.022  
 Mean Difference: 0.000

Relative Accuracy: 15.38  
 Standard Deviation: 0.004  
 Confidence Coefficient: 0.003

APS Indicator: False  
 tValue: 2.306  
 Avg Load: 180

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
6	1	07/23/2013 21:15	07/23/2013 21:35	0.018	0.020	-0.002	180
	2	07/23/2013 21:45	07/23/2013 22:05	0.024	0.020	0.004	179
	3	07/23/2013 22:15	07/23/2013 22:35	0.024	0.020	0.004	181
	4	07/23/2013 22:45	07/23/2013 23:05	0.023	0.018	0.005	179
	5	07/23/2013 23:15	07/23/2013 23:35	0.021	0.017	0.004	180
	6	07/23/2013 23:45	07/24/2013 00:05	0.021	0.023	-0.002	180
	7	07/24/2013 00:20	07/24/2013 00:40	0.022	0.027	-0.005	182
	8	07/24/2013 00:50	07/24/2013 01:10	0.020	0.025	-0.005	180
	9	07/24/2013 01:20	07/24/2013 01:40	0.020	0.023	-0.003	181
	10	07/24/2013 01:50	07/24/2013 02:10	0.023	0.024	-0.001	181

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MPU01816

## RATA Test - Permit

Plant: MPU Source: B9

Parameter: B9PCO

Effective Date/Time: 07/24/2013 03:10

Test Result: Passed

Overall RA: 14.80

CEMS Time Offset :

Test Comment:

RA Calc Method: Standard Equation

Operating Level: Low

Mean CEMS: 15.978

Mean Reference: 15.867

Mean Difference: -0.111

Relative Accuracy: 14.80

Standard Deviation: 2.911

Confidence Coefficient: 2.237

APS Indicator: False

tValue: 2.306

Avg Load: 180

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	07/23/2013 21:15	07/23/2013 21:35	13.3	15.3	-2.0	180	Y
2	07/23/2013 21:45	07/23/2013 22:05	17.5	15.0	2.5	179	Y
3	07/23/2013 22:15	07/23/2013 22:35	17.7	14.9	2.8	181	Y
4	07/23/2013 22:45	07/23/2013 23:05	17.1	13.6	3.5	179	Y
5	07/23/2013 23:15	07/23/2013 23:35	15.3	12.8	2.5	180	Y
6	07/23/2013 23:45	07/24/2013 00:05	15.1	17.4	-2.3	180	Y
7	07/24/2013 00:20	07/24/2013 00:40	15.9	20.4	-4.5	182	
8	07/24/2013 00:50	07/24/2013 01:10	14.8	18.8	-4.0	180	Y
9	07/24/2013 01:20	07/24/2013 01:40	14.8	17.8	-3.0	181	Y
10	07/24/2013 01:50	07/24/2013 02:10	17.2	18.2	-1.0	181	Y

## RATA Test - Permit

Plant: MPU Source: B9

Parameter: B9SO2#M

Effective Date/Time: 07/24/2013 03:10

Test Result: Passed

Overall RA: 7.81

CEMS Time Offset :

Test Comment:

Operating Level: Low  
Mean CEMS: 0.223  
Mean Reference: 0.234  
Mean Difference: 0.011

Relative Accuracy: 7.81  
Standard Deviation: 0.009  
Confidence Coefficient: 0.007

APS Indicator: False  
tValue: 2.306  
Avg Load: 180

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	07/23/2013 21:15	07/23/2013 21:35	0.169	0.177	-0.008	180	Y
2	07/23/2013 21:45	07/23/2013 22:05	0.229	0.216	0.013	179	Y
3	07/23/2013 22:15	07/23/2013 22:35	0.254	0.249	0.005	181	Y
4	07/23/2013 22:45	07/23/2013 23:05	0.189	0.176	0.013	179	Y
5	07/23/2013 23:15	07/23/2013 23:35	0.304	0.277	0.027	180	
6	07/23/2013 23:45	07/24/2013 00:05	0.265	0.242	0.023	180	Y
7	07/24/2013 00:20	07/24/2013 00:40	0.305	0.287	0.018	182	Y
8	07/24/2013 00:50	07/24/2013 01:10	0.238	0.232	0.006	180	Y
9	07/24/2013 01:20	07/24/2013 01:40	0.231	0.213	0.018	181	Y
10	07/24/2013 01:50	07/24/2013 02:10	0.228	0.215	0.013	181	Y

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Report Version 3.8.1100

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8 of 8

MPU01818

## RATA Test - Part 75

Plant: MPU   Source: B9

Parameter: B9CPFLOW

Effective Date/Time: 07/24/2013 13:35

Monitoring System ID: X03

Test Reason: QA-Periodic Quality Assurance

Overall RA: 2.98

CEMS Time Offset :

Test Comment:

Unit of Measure: SCFH

Test Number: XML (X03-Q3-2013-003) / EDR (2)

Frequency: 4QTRS

Test Result: Passed

Overall BAF:

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	07/24/2013 11:10	07/24/2013 11:16	6,294,000.0	6,233,000.0	61,000.0	296	Y
2	07/24/2013 11:17	07/24/2013 11:23	5,762,000.0	6,270,000.0	-508,000.0	299	
3	07/24/2013 11:24	07/24/2013 11:30	5,890,000.0	6,275,000.0	-385,000.0	299	Y
4	07/24/2013 11:40	07/24/2013 11:46	6,359,000.0	6,238,000.0	121,000.0	299	Y
5	07/24/2013 11:47	07/24/2013 11:53	6,438,000.0	6,238,000.0	200,000.0	300	Y
6	07/24/2013 11:54	07/24/2013 12:00	6,360,000.0	6,247,000.0	113,000.0	300	Y
7	07/24/2013 12:08	07/24/2013 12:14	6,319,000.0	6,224,000.0	95,000.0	299	Y
8	07/24/2013 12:15	07/24/2013 12:21	6,347,000.0	6,204,000.0	143,000.0	299	Y
9	07/24/2013 12:22	07/24/2013 12:28	6,291,000.0	6,211,000.0	80,000.0	300	Y
10	07/24/2013 12:29	07/24/2013 12:35	6,295,000.0	6,215,000.0	80,000.0	300	Y

# Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 07/23/2013 21:15 Through 07/23/2013 21:25

Time Online Criteria: 1 minute(s)

Source	B9				
Parameter YUnit	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLB/HR)
					B9STEMP (DEGFAIR)
07/23/13 21:15	4,802,301.0	1,833.0	80.0	29.32	182
07/23/13 21:16	4,836,071.0	1,833.0	80.6	29.34	179
07/23/13 21:17	4,843,251.0	1,833.0	80.7	29.31	178
07/23/13 21:18	4,836,154.0	1,833.0	80.6	29.33	180
07/23/13 21:19	4,802,076.0	1,833.0	80.0	29.33	180
07/23/13 21:20	4,806,590.0	1,833.0	80.1	29.34	182
07/23/13 21:21	4,842,439.0	1,833.0	80.7	29.34	178
07/23/13 21:22	4,839,206.0	1,833.0	80.7	29.32	175
07/23/13 21:23	4,820,048.0	1,833.0	80.3	29.32	181
07/23/13 21:24	4,812,804.0	1,833.0	80.2	29.32	181
07/23/13 21:25	4,807,559.0	1,833.0	80.1	29.32	180
					329.1
Average	4,822,580.8	1,833.0	80.4	29.33	180
Minimum	4,802,076.0	1,833.0	80.0	29.31	175
Maximum	4,843,251.0	1,833.0	80.7	29.34	182
Summation	53,048,489.0	20,163.0	884.0	322.59	3,613.6
Included Data Points	11	11	11	11	11
Total number of Data Points	11	11	11	11	11

Average  
Minimum  
Maximum  
Summation  
Included Data Points  
Total number of Data Points

F = Unit Offline      E = Exceedance      T = Out Of Control      C = Calibration      S = Substituted      \* = Invalid  
M = Maintenance      U = Suspect      Report Version 3.1.1130      U = Startup      D = Shutdown  
Report Generated: 07/23/13 21:30      STACKVISION2\reportuser

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/23/2013 21:45 Through 07/23/2013 21:55

Time Online Criteria: 1 minute(s)

Source	B9				
	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9FLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)
Parameter  Unit					
07/23/13 21:45	4,831,188.0	1,833.0	80.5	29.34	178
07/23/13 21:46	4,820,829.0	1,833.0	80.3	29.34	178
07/23/13 21:47	4,847,598.0	1,833.0	80.8	29.34	177
07/23/13 21:48	4,883,533.0	1,833.0	81.4	29.34	178
07/23/13 21:49	4,854,857.0	1,833.0	80.9	29.33	179
07/23/13 21:50	4,810,045.0	1,833.0	80.2	29.34	177
07/23/13 21:51	4,776,133.0	1,833.0	79.6	29.34	179
07/23/13 21:52	4,749,739.0	1,833.0	79.2	29.33	177
07/23/13 21:53	4,755,030.0	1,833.0	79.3	29.33	181
07/23/13 21:54	4,778,121.0	1,833.0	79.6	29.34	181
07/23/13 21:55	4,783,685.0	1,833.0	79.7	29.33	179
Average	4,808,250.7	1,833.0	80.1	29.34	179
Minimum	4,749,739.0	1,833.0	79.2	29.33	177
Maximum	4,883,533.0	1,833.0	81.4	29.34	181
Summation	52,890,758.0	20,163.0	881.5	322.70	1,964
Included Data Points	11	11	11	11	11
Total number of Data Points	11	11	11	11	11

F = Unit Offline    E = Exceedance  
 M = Maintenance    T = Out Of Control  
 C = Calibration    S = Substituted  
 \* = Suspect    U = Startup  
 Report Generated: 07/23/13 21:57    Report Version 3.1.1130

I = Invalid  
 D = Shutdown  
 STACKVISION2 report user

Below Flow  
Point  
Run #2

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/23/2013 22:15 Through 07/23/2013 22:25

Time Online Criteria: 1 minute(s)

Source	B9					
Parameter Unit( )	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9TEMP (DEGFAHR)
07/23/13 22:15	4.815750.0	1,833.0	80.3	29.35	186	329.2
07/23/13 22:16	4.790535.0	1,833.0	79.8	29.34	186	329.0
07/23/13 22:17	4.775681.0	1,833.0	79.6	29.33	183	328.8
07/23/13 22:18	4.822265.0	1,833.0	80.4	29.34	180	329.2
07/23/13 22:19	4.870737.0	1,833.0	81.2	29.35	180	329.3
07/23/13 22:20	4,858.150.0	1,833.0	81.0	29.34	179	329.2
07/23/13 22:21	4,828.115.0	1,833.0	80.5	29.36	182	329.3
07/23/13 22:22	4,823.379.0	1,833.0	80.4	29.34	181	329.3
07/23/13 22:23	4,832.916.0	1,833.0	80.5	29.35	180	329.2
07/23/13 22:24	4,803.899.0	1,833.0	80.1	29.36	178	329.1
07/23/13 22:25	4,813.124.0	1,833.0	80.2	29.33	178	328.9
Average	4,821,331.9	1,833.0	80.4	29.34	181	329.1
Minimum	4,775,681.0	1,833.0	79.6	29.33	178	328.8
Maximum	4,870,737.0	1,833.0	81.2	29.36	186	329.3
Summation	53,034,651.0	20,163.0	884.0	322.79	1,993	3,620.5
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

# Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/23/2013 22:45 Through 07/23/2013 22:55

Time Online Criteria: 1 minute(s)

Source Parameter )Unit(	B9				
	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)
07/23/13 22:45	4,838,229.0	1,833.0	80.5	29.35	179
07/23/13 22:46	4,801,834.0	1,833.0	80.0	29.34	178
07/23/13 22:47	4,826,138.0	1,833.0	80.4	29.35	175
07/23/13 22:48	4,838,069.0	1,833.0	80.6	29.37	179
07/23/13 22:49	4,823,869.0	1,833.0	80.4	29.35	180
07/23/13 22:50	4,806,198.0	1,833.0	80.1	29.35	177
07/23/13 22:51	4,795,411.0	1,833.0	79.9	29.34	176
07/23/13 22:52	4,797,999.0	1,833.0	80.0	29.34	178
07/23/13 22:53	4,794,255.0	1,833.0	79.9	29.35	178
07/23/13 22:54	4,799,895.0	1,833.0	80.0	29.35	181
07/23/13 22:55	4,803,552.0	1,833.0	80.1	29.35	178
<hr/>					
Average	4,810,495.4	1,833.0	80.2	29.35	178
Minimum	4,794,255.0	1,833.0	79.9	29.34	175
Maximum	4,838,069.0	1,833.0	80.6	29.37	181
Summation	52,915,449.0	20,163.0	881.9	322.84	1,959
Included Data Points	11	11	11	11	11
Total number of Data Points	11	11	11	11	11

# B9 Low Flow Rate

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/23/2013 23:15 Through 07/23/2013 23:25  
Time Online Criteria: 1 minute(s)

B9						
Source	B9CPFLOW (SCFM)	B9FFACT (MBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/23/13 23:15	4,774,108.0	1,833.0	79.6	29.35	181	329.6
07/23/13 23:16	4,788,022.0	1,833.0	79.8	29.33	178	329.3
07/23/13 23:17	4,771,045.0	1,833.0	79.5	29.33	178	328.7
07/23/13 23:18	4,722,752.0	1,833.0	78.7	29.34	179	328.6
07/23/13 23:19	4,733,419.0	1,833.0	78.9	29.34	182	328.7
07/23/13 23:20	4,807,739.0	1,833.0	80.1	29.36	184	329.0
07/23/13 23:21	4,842,640.0	1,833.0	80.7	29.34	183	329.5
07/23/13 23:22	4,832,435.0	1,833.0	80.2	29.34	180	329.7
07/23/13 23:23	4,812,022.0	1,833.0	80.2	29.35	178	329.7
07/23/13 23:24	4,830,221.0	1,833.0	80.5	29.35	177	329.7
07/23/13 23:25	4,830,465.0	1,833.0	80.5	29.34	181	329.8
Average	4,793,169.8	1,833.0	79.9	29.34	180	329.3
Minimum	4,722,752.0	1,833.0	78.7	29.33	177	328.6
Maximum	4,842,640.0	1,833.0	80.7	29.36	184	329.8
Summation	52,724,868.0	20,163.0	878.7	322.77	1,981	3,622.3
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

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Included Data Points  
Total number of Data Points

F = Unit Offline      E = Exceedance  
 M = Maintenance      T = Out Of Control  
 Report Generated: 07/23/13 23:26

Report Version 3.1.1130

C = Calibration      S = Substituted      \* = Invalid  
 U = Startup      D = Shutdown  
 STACKVISION2 report user

MPU01824

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/23/2013 23:45 Through 07/23/2013 23:55

Time Online Criteria: 1 minute(s)

Source	B9				
Parameter	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	
				B9STEAM (KLBS/HR)	
07/23/13 23:45	4,800,818.0	1,833.0	80.0	29.34	179
07/23/13 23:46	4,811,699.0	1,833.0	80.2	29.34	179
07/23/13 23:47	4,825,952.0	1,833.0	80.4	29.36	183
07/23/13 23:48	4,820,669.0	1,833.0	80.3	29.33	180
07/23/13 23:49	4,805,287.0	1,833.0	80.1	29.33	179
07/23/13 23:50	4,798,297.0	1,833.0	80.0	29.33	180
07/23/13 23:51	4,772,070.0	1,833.0	79.5	29.33	180
07/23/13 23:52	4,775,823.0	1,833.0	79.6	29.34	181
07/23/13 23:53	4,821,985.0	1,833.0	80.4	29.33	183
07/23/13 23:54	4,839,816.0	1,833.0	80.7	29.34	183
07/23/13 23:55	4,834,474.0	1,833.0	80.6	29.33	179
 Included Data Points					
Total number of Data Points	11	11	11	11	11

Average	4,809,700.9	1,833.0	80.2	29.34	181	329.1
Minimum	4,772,070.0	1,833.0	79.5	29.33	179	328.3
Maximum	4,839,816.0	1,833.0	80.7	29.36	183	329.7
Summation	52,906,710.0	20,163.0	881.8	322.70	1,986	3,620.0
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

B9 flow Rate

Run 7

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 00:20 Through 07/24/2013 00:30

Time Online Criteria: 1 minute(s)

Source	B9				
	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)
Parameter					
07/24/13 00:20	4,792,515.0	1,833.0	79.9	29.34	185
07/24/13 00:21	4,778,311.0	1,833.0	79.6	29.35	184
07/24/13 00:22	4,765,817.0	1,833.0	79.4	29.33	179
07/24/13 00:23	4,803,394.0	1,833.0	80.1	29.33	181
07/24/13 00:24	4,818,248.0	1,833.0	80.3	29.32	180
07/24/13 00:25	4,836,513.0	1,833.0	80.6	29.31	185
07/24/13 00:26	4,872,804.0	1,833.0	81.2	29.32	184
07/24/13 00:27	4,877,105.0	1,833.0	81.3	29.33	180
07/24/13 00:28	4,833,371.0	1,833.0	80.6	29.33	183
07/24/13 00:29	4,803,172.0	1,833.0	80.1	29.34	183
07/24/13 00:30	4,803,456.0	1,833.0	80.1	29.34	180
					329.4
Average	4,816,791.5	1,833.0	80.3	29.33	182
Minimum	4,765,817.0	1,833.0	79.4	29.31	179
Maximum	4,877,105.0	1,833.0	81.3	29.35	185
Summation	52,984,706.0	20,163.0	883.2	322.64	2,004
Included Data Points	11	11	11	11	11
Total number of Data Points	11	11	11	11	11

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MPU01826

F = Unit Offline    E = Exceedance    S = Substituted    I = Invalid  
 M = Maintenance    T = Out Of Control    U = Startup    D = Shutdown  
 Report Generated: 07/24/13 00:43    Report Version 3.1.1130

C = Calibration    \* = Suspect    C = Calibration    S = Substituted  
 STACKVISION2 report user

# Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 00:50 Through 07/24/2013 01:00  
Time Online Criteria: 1 minute(s)

Source	B9					
Parameter )\Unit(	B9CFLOW (SCFH)	B9FACT (MMBTU/CF)	B9FFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/24/13 00:50	4,829,223.0	1,833.0	80.5	29.34	177	329.2
07/24/13 00:51	4,827,158.0	1,833.0	80.5	29.34	177	329.3
07/24/13 00:52	4,790,571.0	1,833.0	79.8	29.31	182	329.4
07/24/13 00:53	4,796,964.0	1,833.0	79.9	29.32	181	329.3
07/24/13 00:54	4,813,629.0	1,833.0	80.2	29.31	183	329.1
07/24/13 00:55	4,851,113.0	1,833.0	80.9	29.32	179	329.4
07/24/13 00:56	4,864,151.0	1,833.0	81.1	29.33	177	329.2
07/24/13 00:57	4,800,249.0	1,833.0	80.0	29.32	179	328.5
07/24/13 00:58	4,734,785.0	1,833.0	78.9	29.32	181	328.0
07/24/13 00:59	4,746,641.0	1,833.0	79.1	29.31	182	328.3
07/24/13 01:00	4,791,353.0	1,833.0	79.9	29.32	181	328.7
 Included Data Points						
Total number of Data Points	11	11	11	11	11	11

Average	4,804,167.0	1,833.0	80.1	29.32	180	328.9
Minimum	4,734,785.0	1,833.0	78.9	29.31	177	328.0
Maximum	4,864,151.0	1,833.0	81.1	29.34	183	329.4
Summation	52,845,837.0	20,163.0	880.8	322.54	1,979	3,618.4
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 01:20 Through 07/24/2013 01:40

Time Online Criteria: 1 minute(s)

Source	B9					B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
	Parameter JUnit	B9CPFLOW (SCFM)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)		
07/24/13 01:20	4,849,288.0	1,833.0	80.8	29.34	183	329.3	
07/24/13 01:21	4,828,889.0	1,833.0	80.5	29.34	179	329.3	
07/24/13 01:22	4,762,787.0	1,833.0	79.4	29.32	180	328.8	
07/24/13 01:23	4,736,472.0	1,833.0	78.9	29.33	180	328.7	
07/24/13 01:24	4,757,285.0	1,833.0	79.3	29.33	178	328.7	
07/24/13 01:25	4,808,152.0	1,833.0	80.1	29.32	184	329.2	
07/24/13 01:26	4,816,286.0	1,833.0	80.3	29.34	183	329.8	
07/24/13 01:27	4,797,978.0	1,833.0	80.0	29.34	180	330.0	
07/24/13 01:28	4,784,391.0	1,833.0	79.7	29.34	180	330.0	
07/24/13 01:29	4,798,665.0	1,833.0	80.0	29.35	178	329.9	
07/24/13 01:30	4,844,030.0	1,833.0	80.7	29.36	180	330.0	
07/24/13 01:31	4,851,340.0	1,833.0	80.9	29.33	184	330.1	
07/24/13 01:32	4,842,968.0	1,833.0	80.7	29.32	184	330.0	
07/24/13 01:33	4,847,468.0	1,833.0	80.8	29.31	183	330.0	
07/24/13 01:34	4,843,895.0	1,833.0	80.7	29.32	183	329.9	
07/24/13 01:35	4,835,971.0	1,833.0	80.6	29.34	181	330.0	
07/24/13 01:36	4,823,542.0	1,833.0	80.4	29.34	180	330.0	
07/24/13 01:37	4,816,008.0	1,833.0	80.3	29.33	183	330.0	
07/24/13 01:38	4,824,421.0	1,833.0	80.4	29.31	180	330.0	
07/24/13 01:39	4,830,107.0	1,833.0	80.5	29.33	181	330.1	
07/24/13 01:40	4,817,491.0	1,833.0	80.3	29.33	184	330.4	
<hr/>							
Average	4,815,116.4	1,833.0	80.3	29.33	181	329.7	
Minimum	4,736,472.0	1,833.0	78.9	29.31	178	328.7	
Maximum	4,851,340.0	1,833.0	80.9	29.36	184	330.4	
Summation	101,117,444.0	38,493.0	1,685.3	615.97	3,808	6,924.2	
Included Data Points	21	21	21	21	21	21	
Total number of Data Points	21	21	21	21	21	21	

Average  
Minimum  
Maximum  
Summation  
Included Data Points  
Total number of Data Points

F = Unit Offline  
M = Maintenance  
T = Out Of Control  
Report Generated: 07/24/13 01:42  
Report Version 3.1.130

E = Exceedance  
S = Substituted  
\* = Suspect  
U = Startup  
D = Shutdown  
= Invalid

MPU01828

# Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 01:50 Through 07/24/2013 02:00  
Time Online Criteria: 1 minute(s)

Source	B9				
	B9CPFLOW (SCFH)	B9FFFACT (MMBTU/JCF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)
07/24/13 01:50	4,760,014.0	1,833.0	79.3	29.33	180
07/24/13 01:51	4,763,648.0	1,833.0	79.4	29.32	178
07/24/13 01:52	4,818,181.0	1,833.0	80.3	29.32	179
07/24/13 01:53	4,814,613.0	1,833.0	80.2	29.32	179
07/24/13 01:54	4,825,023.0	1,833.0	80.4	29.35	179
07/24/13 01:55	4,847,882.0	1,833.0	80.8	29.33	182
07/24/13 01:56	4,848,269.0	1,833.0	80.7	29.34	179
07/24/13 01:57	4,841,036.0	1,833.0	80.7	29.31	180
07/24/13 01:58	4,817,276.0	1,833.0	80.3	29.32	180
07/24/13 01:59	4,777,782.0	1,833.0	79.6	29.31	181
07/24/13 02:00	4,760,448.0	1,833.0	79.3	29.33	183
<hr/>					
Average	4,806,288.4	1,833.0	80.1	29.33	180
Minimum	4,760,014.0	1,833.0	79.3	29.31	178
Maximum	4,847,882.0	1,833.0	80.8	29.35	183
Summation	52,869,172.0	20,163.0	881.0	322.58	3,635.3
Included Data Points	11	11	11	11	11
Total number of Data Points	11	11	11	11	11

B9 Min Flow  
RA7A  
Run #2

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 11:10 Through 07/24/2013 11:16

Time Online Criteria: 1 minute(s)

Source		B9					
Parameter	Unit( )	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/24/13 11:10	6,224,078.0	1,833.0		103.7	29.50	295	336.5
07/24/13 11:11	6,217,961.0	1,833.0		103.6	29.50	296	336.3
07/24/13 11:12	6,211,544.0	1,833.0		103.5	29.49	294	336.2
07/24/13 11:13	6,213,880.0	1,833.0		103.6	29.50	297	336.1
07/24/13 11:14	6,244,841.0	1,833.0		104.1	29.50	296	335.9
07/24/13 11:15	6,271,425.0	1,833.0		104.5	29.49	297	335.9
07/24/13 11:16	6,245,196.0	1,833.0		104.1	29.49	298	335.8
		Average	6,232,703.6	1,833.0	103.9	29.50	336.1
		Minimum	6,211,544.0	1,833.0	103.5	29.49	294
		Maximum	6,271,425.0	1,833.0	104.5	29.50	298
		Summation	43,628,925.0	12,831.0	727.1	206.47	2,352.7
Included Data Points	7			7	7	7	7
Total number of Data Points	7			7	7	7	7

B9 Mid Flow  
Run # 2

## Average Data

Plant: Manitowoc Public Utilities  
Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 11:17 Through 07/24/2013 11:23  
Time Online Criteria: 1 minute(s)

Source	B9				
	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)
Parameter Unit(					
07/24/13 11:17	6,250,898.0	1,833.0	104.2	29.51	298
07/24/13 11:18	6,293,915.0	1,833.0	104.9	29.53	297
07/24/13 11:19	6,297,569.0	1,833.0	104.8	29.50	299
07/24/13 11:20	6,274,923.0	1,833.0	104.6	29.51	299
07/24/13 11:21	6,258,150.0	1,833.0	104.3	29.51	299
07/24/13 11:22	6,259,457.0	1,833.0	104.3	29.51	300
07/24/13 11:23	6,265,698.0	1,833.0	104.4	29.49	299
					335.1
					334.9
Average	6,270,087.1	1,833.0	104.5	29.51	299
Minimum	6,250,898.0	1,833.0	104.2	29.49	297
Maximum	6,293,915.0	1,833.0	104.9	29.53	300
Summation	43,890,610.0	12,831.0	731.5	206.56	2,091
Included Data Points	7	7	7	7	7
Total number of Data Points	7	7	7	7	7

F = Unit Offline      E = Exceedance      C = Calibration      S = Substituted  
 M = Maintenance      T = Out Of Control      \* = Suspect      U = Startup  
 Report Generated: 07/24/13 11:26      Report Version 3.1.1130      D = Shutdown  
 STACKVISION2/reporter

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 11:24 Through 07/24/2013 11:30

Time Online Criteria: 1 minute(s)

Source	B9				
	B9CPFLOW (SCFH)	B9FACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)
Parameter )Unit(					
07/24/13 11:24	6,282,466.0	1,833.0	104.4	29.50	299
07/24/13 11:25	6,288,931.0	1,833.0	104.5	29.48	300
07/24/13 11:26	6,288,221.0	1,833.0	104.5	29.49	298
07/24/13 11:27	6,288,248.0	1,833.0	104.8	29.50	298
07/24/13 11:28	6,289,491.0	1,833.0	105.0	29.48	299
07/24/13 11:29	6,281,524.0	1,833.0	104.7	29.51	299
07/24/13 11:30	6,257,756.0	1,833.0	104.3	29.50	300
					335.9
Average	6,275,233.9	1,833.0	104.6	29.49	299
Minimum	6,257,756.0	1,833.0	104.3	29.48	298
Maximum	6,289,491.0	1,833.0	105.0	29.51	300
Summation	43,926,637.0	12,831.0	732.2	206.46	2,093
Included Data Points	7	7	7	7	7
Total number of Data Points	7	7	7	7	7

F = Unit Offline  
M = Maintenance

E = Exceedance  
T = Out Of Control

C = Calibration  
\* = Suspect

S = Substituted  
U = Startup

V = Variable  
D = Shutdown

STANDARD/REPORTUSER

B9 mid flow RATA

## Average Data

Plant: Manitowoc Public Utilities  
Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 11:40 Through 07/24/2013 11:46  
Time Online Criteria: 1 minute(s)

Source	B9				
Parameter Unit( )	B9CPIFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBSIHR)
					B9STEMP (DEGFAHR)
07/24/13 11:40	6,242,511.0	1,833.0	104.0	29.49	299
07/24/13 11:41	6,232,460.0	1,833.0	103.9	29.51	299
07/24/13 11:42	6,247,851.0	1,833.0	104.1	29.49	300
07/24/13 11:43	6,252,440.0	1,833.0	104.2	29.49	301
07/24/13 11:44	6,248,472.0	1,833.0	104.1	29.49	300
07/24/13 11:45	6,221,777.0	1,833.0	103.7	29.48	299
07/24/13 11:46	6,222,961.0	1,833.0	103.7	29.48	298
<hr/>					
Average	6,238,353.1	1,833.0	104.0	29.49	299
Minimum	6,221,777.0	1,833.0	103.7	29.48	298
Maximum	6,252,440.0	1,833.0	104.2	29.51	301
Summation	43,668,472.0	12,831.0	727.7	206.43	2,096
Included Data Points	7	7	7	7	7
Total number of Data Points	7	7	7	7	7

**F = Unit Offline**    **E = Exceedance**    **C = Calibration**  
**M = Maintenance**    **T = Out Of Control**    **S = Substituted**  
**Report Generated: 07/24/13 11:57**    **\* = Suspect**    **U = Startup**  
**Report Version 3.1.1130**    **= Invalid**    **D = Shutdown**  
**STACKVISION2\reportuser**

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 11:47 Through 07/24/2013 11:53

Time Online Criteria: 1 minute(s)

Source	B9				
	B9CFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)
Parameter )\Unit(					
07/24/13 11:47	6,236,663.0	1,833.0	103.9	29.48	298
07/24/13 11:48	6,224,926.0	1,833.0	103.7	29.49	300
07/24/13 11:49	6,216,132.0	1,833.0	103.6	29.51	300
07/24/13 11:50	6,228,640.0	1,833.0	103.8	29.48	299
07/24/13 11:51	6,242,674.0	1,833.0	104.0	29.50	300
07/24/13 11:52	6,253,107.0	1,833.0	104.2	29.53	300
07/24/13 11:53	6,265,495.0	1,833.0	104.4	29.48	301
					337.6
					337.7
Average	6,238,233.9	1,833.0	103.9	29.50	300
Minimum	6,216,132.0	1,833.0	103.6	29.48	298
Maximum	6,265,495.0	1,833.0	104.4	29.53	301
Summation	43,667,637.0	12,831.0	727.6	206.47	2,098
Included Data Points	7	7	7	7	7
Total number of Data Points	7	7	7	7	7

*B9 mid flow chart*  
Run 4

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 11:54 Through 07/24/2013 12:00  
Time Online Criteria: 1 minute(s)

Source	B9					
Parameter )Unit(	B9CPFLOW (SCFM)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/24/13 11:54	6,252,834.0	1,833.0	104.4	29.49	301	337.7
07/24/13 11:55	6,256,809.0	1,833.0	104.3	29.49	299	337.8
07/24/13 11:56	6,265,859.0	1,833.0	104.4	29.48	298	337.8
07/24/13 11:57	6,263,367.0	1,833.0	104.4	29.50	299	337.5
07/24/13 11:58	6,235,334.0	1,833.0	103.9	29.50	300	337.4
07/24/13 11:59	6,226,098.0	1,833.0	103.8	29.49	299	337.7
07/24/13 12:00	6,222,197.0	1,833.0	103.7	29.50	301	337.6
 B9						
Average	6,247,499.7	1,833.0	104.1	29.49	300	337.6
Minimum	6,222,197.0	1,833.0	103.7	29.48	298	337.4
Maximum	6,265,859.0	1,833.0	104.4	29.50	301	337.8
Summation	43,732,498.0	12,831.0	728.9	206.45	2,097	2,363.5
Included Data Points	7	7	7	7	7	7
Total number of Data Points	7	7	7	7	7	7

Included Data Points  
Total number of Data Points

F = Unit Offline      E = Exceedance      C = Calibration      S = Substituted      I = Invalid  
 M = Maintenance      T = Out Of Control      \* = Suspect      U = Startup      D = Shutdown  
 Report Generated: 07/24/13 12:01      Report Version 3.1.1130      STACKVISON2\reportuser

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 12:08 Through 07/24/2013 12:14

Time Online Criteria: 1 minute(s)

Source	B9				
	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)
Parameter Unit(					
07/24/13 12:08	6,245,984.0	1,833.0	104.1	29.48	299
07/24/13 12:09	6,244,781.0	1,833.0	104.1	29.49	299
07/24/13 12:10	6,212,159.0	1,833.0	103.5	29.48	299
07/24/13 12:11	6,212,341.0	1,833.0	103.5	29.50	299
07/24/13 12:12	6,226,779.0	1,833.0	103.8	29.47	300
07/24/13 12:13	6,280,092.0	1,833.0	103.8	29.48	300
07/24/13 12:14	6,196,889.0	1,833.0	103.3	29.49	300
					339.2
Average	6,224,147.0	1,833.0	103.7	29.48	299
Minimum	6,196,889.0	1,833.0	103.3	29.47	299
Maximum	6,245,984.0	1,833.0	104.1	29.50	300
Summation	43,569,029.0	12,831.0	726.1	206.39	2,096
Included Data Points	7	7	7	7	7
Total number of Data Points	7	7	7	7	7

F = Unit Offline      E = Exceedance      C = Calibration      S = Substituted  
 M = Maintenance      T = Out Of Control      \* = Suspect      U = Startup      D = Shutdown  
 Report Generated: 07/24/13 12:15      Report Version 3.1.1130      STACKVISION2/reportuser

B9 mid flow PTTA  
R-n 8

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 12:15 Through 07/24/2013 12:21  
Time Online Criteria: 1 minute(s)

Source	B9					
Parameter	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9TEMP (DEGFAHR)
07/24/13 12:15	6,185,840.0	1,833.0	103.1	29.49	300	339.4
07/24/13 12:16	6,221,782.0	1,833.0	103.7	29.48	300	339.6
07/24/13 12:17	6,232,994.0	1,833.0	103.9	29.47	299	339.7
07/24/13 12:18	6,206,990.0	1,833.0	103.4	29.49	300	339.4
07/24/13 12:19	6,189,679.0	1,833.0	103.2	29.48	299	339.2
07/24/13 12:20	6,186,154.0	1,833.0	103.1	29.47	298	339.3
07/24/13 12:21	6,206,683.0	1,833.0	103.4	29.47	298	339.3
 Average						
6,204,303.1						
Minimum						
6,185,840.0						
Maximum						
6,232,994.0						
Summation						
43,430,122.0						
Included Data Points						
7						
Total number of Data Points						
7						

# Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 12:22 Through 07/24/2013 12:28

Time Online Criteria: 1 minute(s)

Source	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
Parameter Unit(						
07/24/13 12:22	6,202,504.0	1,833.0	103.4	29.47	301	339.3
07/24/13 12:23	6,159,825.0	1,833.0	102.7	29.48	302	339.1
07/24/13 12:24	6,168,480.0	1,833.0	102.8	29.49	301	338.9
07/24/13 12:25	6,211,924.0	1,833.0	103.5	29.50	300	338.9
07/24/13 12:26	6,233,211.0	1,833.0	103.9	29.51	299	339.1
07/24/13 12:27	6,233,700.0	1,833.0	103.9	29.49	300	339.0
07/24/13 12:28	6,264,939.0	1,833.0	104.4	29.46	300	339.1
Average	6,210,654.7	1,833.0	103.5	29.49	300	339.1
Minimum	6,159,825.0	1,833.0	102.7	29.46	299	338.9
Maximum	6,264,939.0	1,833.0	104.4	29.51	302	339.3
Summation	43,474,583.0	12,831.0	724.6	206.40	2,103	2,373.4
Included Data Points	7	7	7	7	7	7
Total number of Data Points						

Average  
Minimum  
Maximum  
Summation  
Included Data Points  
Total number of Data Points

F = Unit Offline  
M = Maintenance  
T = Out Of Control

E = Exceedance  
S = Substituted  
U = Startup

Report Generated: 07/24/13 12:29  
Report Version 3.1.1130

\* = Suspect  
C = Calibration  
U = Startups  
D = Shutdown

I = Invalid  
S = Substituted  
U = Startup  
D = Shutdown

B9 mid flow RATA  
Run 10

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 12:29 Through 07/24/2013 12:35  
Time Online Criteria: 1 minute(s)

Source	B9			
Parameter Parameter Unit	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)
				B9STEAM (KLBS/HR)
07/24/13 12:29	6,272,246.0	1,883.0	104.5	29.47
07/24/13 12:30	6,241,045.0	1,883.0	104.0	29.45
07/24/13 12:31	6,202,275.0	1,883.0	103.4	29.47
07/24/13 12:32	6,175,868.0	1,883.0	102.9	29.48
07/24/13 12:33	6,189,547.0	1,883.0	103.2	29.47
07/24/13 12:34	6,213,531.0	1,883.0	103.6	29.49
07/24/13 12:35	6,207,549.2	1,883.0	103.5	29.48
				300
				301
				299
				339.4
				339.5
				339.3
				339.3
				338.9
				339.4
				339.2
				338.9
				338.9
Average	6,214,586.2	1,883.0	103.6	29.47
Minimum	6,175,868.0	1,883.0	102.9	29.45
Maximum	6,272,246.0	1,883.0	104.5	29.49
Summation	43,502,061.2	12,851.0	725.1	206.31
Included Data Points	7	7	7	7
Total number of Data Points	7	7	7	7

29

**F = Unit Offline**   **E = Exceedance**   **S = Substituted**   **I = Invalid**  
**M = Maintenance**   **T = Out Of Control**   **\* = Suspect**   **U = Startup**   **D = Shutdown**  
 Report Generated: 07/24/13 12:36      Report Version 3.1.1130      STACKVISION2\reportuser

**Average Data**  
 Plant: Manitowoc Public Utilities  
 Interval: 1 Minute  
 Type: Roll with BAF Applied  
 Report Period: 07/23/2013 21:15 Through 07/23/2013 21:35  
 Time Online Criteria: 1 minute(s)

B9 GAS DATA  
 Run#1

Source	B9						B9SO2#M (#MMBTU)	B9STEAM (KLBSHHR)
	B9CO#M (#MMBTU)	B9CPCCO (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#MMBTU)		
07/23/13 21:15	0.018	10.2	57.0	55.3	1,833.0	0.122	14.0	0.165
07/23/13 21:16	0.017	10.3	55.7	55.1	1,833.0	0.118	12.8	0.163
07/23/13 21:17	0.017	10.1	55.7	57.2	1,833.0	0.121	13.2	0.172
07/23/13 21:18	0.019	10.0	56.2	55.6	1,833.0	0.123	14.1	0.169
07/23/13 21:19	0.017	10.1	54.5	55.3	1,833.0	0.118	13.1	0.167
07/23/13 21:20	0.020	10.1	54.5	55.4	1,833.0	0.118	15.2	0.167
07/23/13 21:21	0.017	10.1	53.4	59.3	1,833.0	0.116	12.8	0.179
07/23/13 21:22	0.018	10.2	54.1	57.9	1,833.0	0.116	13.7	0.173
07/23/13 21:23	0.018	10.1	54.8	55.5	1,833.0	0.119	13.9	0.167
07/23/13 21:24	0.017	10.0	55.4	46.6	1,833.0	0.121	12.7	0.142
07/23/13 21:25	0.020	10.0	54.2	44.1	1,833.0	0.119	14.9	0.134
07/23/13 21:26	0.022	10.2	56.7	40.8	1,833.0	0.122	16.8	0.122
07/23/13 21:27	0.022	10.3	58.3	36.2	1,833.0	0.124	16.7	0.107
07/23/13 21:28	0.019	10.2	54.3	55.2	1,833.0	0.117	14.8	0.165
07/23/13 21:29	0.022	10.2	52.3	65.6	1,833.0	0.112	16.8	0.196
07/23/13 21:30	0.024	10.2	52.6	71.0	1,833.0	0.113	18.5	0.212
07/23/13 21:31	0.023	10.1	52.9	78.2	1,833.0	0.115	17.7	0.236
07/23/13 21:32	0.025	10.1	53.7	82.2	1,833.0	0.115	19.1	0.245
07/23/13 21:33	0.020	10.2	54.5	75.5	1,833.0	0.117	15.6	0.225
07/23/13 21:34	0.023	10.2	53.8	72.9	1,833.0	0.115	17.7	0.217
07/23/13 21:35	0.024	10.2	53.7	67.4	1,833.0	0.115	18.1	0.201
Average	0.020	10.2	54.7	59.2	1,833.0	0.118	15.3	0.177
Minimum	0.017	10.0	52.3	36.2	1,833.0	0.112	12.7	0.107
Maximum	0.025	10.3	58.3	82.2	1,833.0	0.124	19.1	0.245
Summation	0.422	213.2	1,148.3	1,242.3	38,493.0	2,476	322.2	3,724
Included Data Points	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21

30

F = Unit Offline      E = Exceedance      M = Maintenance      T = Out Of Control  
 Report Generated: 07/23/13 21:36      Report Version 3.1.1130

C = Calibration      S = Substituted      \* = Suspect      U = Startup      D = Shutdown  
 STACKVISION2/reportuser

Plant: Manitowoc Public Utilities  
 Interval: 1 Minute  
 Type: Roll with BAF Applied  
 Report Period: 07/23/2013 21:15 Through 07/23/2013 21:35  
 Time Online Criteria: 1 minute(s)

1 of 1

MPU01840

# Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/23/2013 21:45 Through 07/23/2013 22:05

Time Online Criteria: 1 minute(s)

B9GAS RATE  
Run #2

Source	B9						B9SO2#M (#MMBTU)			B9STEAM (KLBSHR)	
	Parameter Unit	B9CO#M (#MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTUCF)	B9NOX#M (#MMBTU)	B9PCO (PPM)	B9PCCO (PPM)	B9SO2#M (#MMBTU)	
07/23/13 21:45	0.022	10.2	55.8	64.8	1,833.0	0.120	16.4	0.193	0.180	15.4	178
07/23/13 21:46	0.020	10.2	58.1	60.2	1,833.0	0.125	15.4	0.181	0.189	16.7	178
07/23/13 21:47	0.021	10.0	59.0	59.5	1,833.0	0.129	15.4	0.181	0.189	16.7	177
07/23/13 21:48	0.022	10.0	58.7	62.2	1,833.0	0.128	16.7	0.189	0.184	16.9	178
07/23/13 21:49	0.023	10.0	59.6	67.0	1,833.0	0.130	16.9	0.204	0.211	17.6	179
07/23/13 21:50	0.024	10.0	58.3	69.3	1,833.0	0.128	17.6	0.222	0.222	15.3	177
07/23/13 21:51	0.020	10.0	57.2	73.1	1,833.0	0.125	16.3	0.232	0.232	16.1	179
07/23/13 21:52	0.022	10.0	55.9	76.2	1,833.0	0.122	16.3	0.221	0.221	16.1	177
07/23/13 21:53	0.021	10.0	56.5	72.7	1,833.0	0.124	16.1	0.210	0.210	16.7	181
07/23/13 21:54	0.022	10.1	56.7	69.8	1,833.0	0.123	15.7	0.234	0.234	15.7	179
07/23/13 21:55	0.021	10.1	56.5	77.6	1,833.0	0.122	16.1	0.232	0.232	16.1	178
07/23/13 21:56	0.021	10.1	57.2	77.0	1,833.0	0.124	16.3	0.220	0.220	16.3	178
07/23/13 21:57	0.022	9.9	57.7	71.5	1,833.0	0.128	13.3	0.242	0.242	13.3	181
07/23/13 21:58	0.018	10.1	55.1	80.2	1,833.0	0.119	14.0	0.247	0.247	14.0	176
07/23/13 21:59	0.018	10.1	55.8	81.9	1,833.0	0.121	14.8	0.244	0.244	14.4	181
07/23/13 22:00	0.019	10.2	55.7	81.8	1,833.0	0.120	14.4	0.246	0.246	13.2	181
07/23/13 22:01	0.019	10.3	55.5	83.2	1,833.0	0.118	13.2	0.236	0.236	11.8	178
07/23/13 22:02	0.017	10.2	56.3	79.0	1,833.0	0.121	11.8	0.222	0.222	11.7	180
07/23/13 22:03	0.015	10.3	57.5	75.3	1,833.0	0.122	11.7	0.206	0.206	11.1	184
07/23/13 22:04	0.015	10.3	59.3	69.7	1,833.0	0.126	10.5	0.157	0.157	10.5	182
07/23/13 22:05	0.014	10.3	64.2	53.3	1,833.0	0.136	10.5	0.157	0.157	10.5	182
<hr/>											
Average	0.020	10.1	57.5	71.7	1,833.0	0.124	15.0	0.216	0.216	179	
Minimum	0.014	55.1	53.3	1,833.0	0.118	11.1	0.157	0.157	0.157	176	
Maximum	0.024	64.2	83.2	1,833.0	0.136	17.6	0.247	0.247	0.247	184	
Summation	0.416	1,206.6	1,505.3	38,493.0	2,611	315.2	4,529	4,529	4,529	3,760	
Included Data Points	21	21	21	21	21	21	21	21	21	21	
Total number of Data Points	21	21	21	21	21	21	21	21	21	21	

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F = Unit Offline    E = Exceedance    T = Out Of Control  
 M = Maintenance    S = Substituted    U = Startup  
 Report Generated: 07/23/13 22:08    Report Version 3.1.1130

C = Calibration    \* = Suspect    D = Shutdown  
 S = Substituted    U = Startup  
 STACKVISION2/reporter  
 1 = Inver

MPU01841

# Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/23/2013 22:15 Through 07/23/2013 22:35

Time Online Criteria: 1 minute(s)

B9 GAS RA7A  
Run # 3

Source	B9						B9PCO (PPM)	B9NOX#M (#MMBTU)	B9SO#M (#MMBTU)	B9TEAM (KLBS/IHR)
	B9CC#M (#MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#MMBTU)				
07/23/13 22:15	0.016	10.0	52.0	82.3	1,833.0	0.114	12.1	0.250	186	186
07/23/13 22:16	0.016	10.0	50.5	83.6	1,833.0	0.111	11.9	0.254	186	186
07/23/13 22:17	0.016	9.8	47.9	89.6	1,833.0	0.107	11.9	0.278	183	183
07/23/13 22:18	0.017	10.0	47.1	91.1	1,833.0	0.103	12.4	0.277	180	180
07/23/13 22:19	0.020	10.1	45.8	90.5	1,833.0	0.099	15.1	0.273	180	180
07/23/13 22:20	0.018	10.1	47.8	83.9	1,833.0	0.104	14.0	0.253	179	179
07/23/13 22:21	0.019	10.1	49.5	79.6	1,833.0	0.107	14.2	0.240	182	182
07/23/13 22:22	0.023	10.0	48.9	80.4	1,833.0	0.107	17.1	0.245	181	181
07/23/13 22:23	0.024	10.1	49.7	80.3	1,833.0	0.108	18.0	0.242	180	180
07/23/13 22:24	0.024	10.1	48.3	85.6	1,833.0	0.105	18.5	0.258	178	178
07/23/13 22:25	0.021	10.1	49.2	81.9	1,833.0	0.107	16.2	0.247	178	178
07/23/13 22:26	0.021	10.1	48.6	83.8	1,833.0	0.105	15.7	0.252	181	181
07/23/13 22:27	0.021	10.3	47.5	89.3	1,833.0	0.101	15.9	0.264	185	185
07/23/13 22:28	0.020	10.2	47.6	90.0	1,833.0	0.102	15.2	0.268	178	178
07/23/13 22:29	0.017	10.2	50.5	89.0	1,833.0	0.108	13.4	0.265	179	179
07/23/13 22:30	0.019	10.2	50.8	86.0	1,833.0	0.109	14.6	0.257	182	182
07/23/13 22:31	0.023	10.2	51.9	81.0	1,833.0	0.111	18.0	0.242	182	182
07/23/13 22:32	0.021	10.2	51.9	75.5	1,833.0	0.111	16.4	0.225	179	179
07/23/13 22:33	0.020	10.1	51.9	73.6	1,833.0	0.112	15.3	0.222	179	179
07/23/13 22:34	0.018	10.2	54.5	70.4	1,833.0	0.117	13.8	0.210	180	180
07/23/13 22:35	0.018	10.1	55.0	67.1	1,833.0	0.119	13.5	0.202	184	184
Average		10.1	49.9	82.6	1,833.0	0.108	14.9	0.249	181	181
Minimum		9.8	45.8	67.1	1,833.0	0.099	11.9	0.202	178	178
Maximum		10.3	55.0	91.1	1,833.0	0.119	18.5	0.278	186	186
Summation		212.2	1,046.9	1,734.5	38,493.0	2,267	313.2	5,224	3,802	3,802
Included Data Points		21	21	21	21	21	21	21	21	21
Total number of Data Points		21								

F = Unit Offline      E = Exceedance      S = Substituted  
 M = Maintenance      T = Out Of Control      U = Startup  
 \* = Suspect      D = Shutdown

Report Generated: 07/23/2013 22:37

MPU01842

1 of 1

# Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/23/2013 22:45 Through 07/23/2013 23:05

Time Online Criteria: 1 minute(s)

B9 Gas Rate  
Run 4

Source	B9						B9SO2#M (#MMBTU/H)	B9STEAM (KLBS/HR)
	B9CO#M (#MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#MMBTU)		
07/23/13 22:45	0.017	10.0	54.7	70.6	1,833.0	0.120	12.4	0.215
07/23/13 22:46	0.018	10.0	56.2	69.2	1,833.0	0.123	13.6	0.211
07/23/13 22:47	0.016	10.0	55.3	68.2	1,833.0	0.121	12.2	0.208
07/23/13 22:48	0.018	10.0	54.7	69.8	1,833.0	0.120	13.2	0.212
07/23/13 22:49	0.019	9.8	54.1	65.5	1,833.0	0.121	14.2	0.203
07/23/13 22:50	0.018	9.8	53.5	63.3	1,833.0	0.119	13.3	0.197
07/23/13 22:51	0.021	9.8	52.8	62.7	1,833.0	0.118	15.6	0.195
07/23/13 22:52	0.020	9.9	55.9	54.5	1,833.0	0.124	15.2	0.168
07/23/13 22:53	0.018	10.1	65.5	25.1	1,833.0	0.142	13.6	0.076
07/23/13 22:54	0.020	10.0	66.6	14.9	1,833.0	0.146	14.9	0.045
07/23/13 22:55	0.020	10.1	67.6	14.0	1,833.0	0.146	15.4	0.042
07/23/13 22:56	0.021	10.2	64.8	15.3	1,833.0	0.139	15.6	0.046
07/23/13 22:57	0.019	10.1	58.5	29.8	1,833.0	0.127	14.5	0.090
07/23/13 22:58	0.019	10.1	56.2	51.6	1,833.0	0.122	14.7	0.155
07/23/13 22:59	0.015	9.9	55.0	60.9	1,833.0	0.122	11.5	0.187
07/23/13 23:00	0.016	10.0	55.0	69.4	1,833.0	0.120	11.9	0.211
07/23/13 23:01	0.018	10.0	54.4	76.1	1,833.0	0.119	13.8	0.232
07/23/13 23:02	0.019	10.1	54.2	83.6	1,833.0	0.117	14.2	0.252
07/23/13 23:03	0.017	10.1	54.2	83.3	1,833.0	0.117	13.1	0.251
07/23/13 23:04	0.016	10.0	52.5	83.0	1,833.0	0.115	12.0	0.253
07/23/13 23:05	0.015	10.2	52.9	84.3	1,833.0	0.114	11.3	0.251
Average							13.6	0.176
Minimum	0.018	10.0	56.9	57.9	1,833.0	0.124	11.3	0.042
Maximum	0.015	9.8	52.5	14.0	1,833.0	0.114	11.3	0.253
Summation	0.021	10.2	67.6	84.3	1,833.0	0.146	15.6	0.285
Included Data Points	0.380	210.2	1,194.6	1,215.1	38,493.0	2,612	286.2	3,750
Total number of Data Points	21	21	21	21	21	21	21	21

F = Unit Offline      E = Exceedance      T = Out Of Control      S = Substituted      \* = Invalid  
 M = Maintenance      C = Calibration      \* = Suspect      U = Startup      D = Shutdown  
 Report Generated: 07/23/13 23:06      Report Version 3.1.130      STACKVISION2/reporter

B9 Gas Rate  
Run 4

Parameter Unit( )

Source

Time Online Criteria: 1 minute(s)

Report Period: 07/23/2013 22:45 Through 07/23/2013 23:05

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

B9 Gas Rate  
Run 5

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/23/2013 23:15 Through 07/23/2013 23:35

Time Online Criteria: 1 minute(s)

Source B9

Parameter Unit( )	B9CO#M (#MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/JCF)	B9NOX#M (#MMBTU)	B9PCO (PPM)	B9SO2#M (#MMBTU)	B9STEAM (KLBSHR)
07/23/13 23:15	0.017	10.0	53.2	76.4	1,833.0	0.116	12.8	0.232	181
07/23/13 23:16	0.017	10.0	52.2	87.5	1,833.0	0.114	12.6	0.266	178
07/23/13 23:17	0.015	10.0	51.6	93.6	1,833.0	0.113	11.3	0.285	178
07/23/13 23:18	0.013	10.0	52.5	92.8	1,833.0	0.115	10.0	0.282	179
07/23/13 23:19	0.015	10.0	50.9	96.8	1,833.0	0.111	11.1	0.295	182
07/23/13 23:20	0.014	10.1	53.0	96.1	1,833.0	0.115	10.9	0.290	184
07/23/13 23:21	0.012	10.1	53.2	94.2	1,833.0	0.115	8.9	0.284	183
07/23/13 23:22	0.015	10.0	54.5	87.6	1,833.0	0.119	11.6	0.267	180
07/23/13 23:23	0.015	10.1	55.2	87.0	1,833.0	0.120	11.2	0.282	178
07/23/13 23:24	0.014	9.9	54.7	85.4	1,833.0	0.121	10.5	0.262	177
07/23/13 23:25	0.014	9.9	52.5	88.1	1,833.0	0.116	10.1	0.271	181
07/23/13 23:26	0.015	10.0	51.4	95.1	1,833.0	0.112	11.5	0.289	184
07/23/13 23:27	0.016	10.0	50.8	92.2	1,833.0	0.111	12.1	0.281	176
07/23/13 23:28	0.018	10.1	50.3	95.1	1,833.0	0.109	13.6	0.287	175
07/23/13 23:29	0.019	10.1	50.5	91.6	1,833.0	0.109	14.0	0.276	178
07/23/13 23:30	0.023	10.0	51.8	91.2	1,833.0	0.113	17.0	0.278	181
07/23/13 23:31	0.021	10.0	52.5	94.2	1,833.0	0.115	15.5	0.287	183
07/23/13 23:32	0.022	10.0	52.1	94.7	1,833.0	0.114	16.9	0.288	183
07/23/13 23:33	0.021	10.1	51.1	94.5	1,833.0	0.111	16.0	0.285	177
07/23/13 23:34	0.022	10.0	52.4	91.0	1,833.0	0.115	16.1	0.277	178
07/23/13 23:35	0.020	9.9	53.1	87.1	1,833.0	0.117	14.7	0.268	180
Average	0.017	10.0	52.4	91.1	1,833.0	0.114	12.8	0.277	180
Minimum	0.012	9.9	50.3	76.4	1,833.0	0.109	8.9	0.232	175
Maximum	0.023	10.1	55.2	96.8	1,833.0	0.121	17.0	0.285	184
Summation	0.358	210.3	1,099.5	1,912.2	38,493.0	2,401	268.4	5,812	3,776
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21	21

34

Average  
Minimum  
Maximum  
Summation  
Included Data Points  
Total number of Data Points

C = Calibration  
\* = Suspect  
E = Exceedance  
T = Out Of Control  
S = Substituted  
U = Startup

F = Unit Offline  
M = Maintenance  
Report Generated: 07/23/13 23:36  
Report Version 3.1.1130

E = Exceedance  
T = Out Of Control  
S = Substituted  
U = Startup  
D = Shutdown  
STACKVISION2\reporter

B9 = Average  
Run 5  
B9CO#M (#MMBTU)  
B9CPCO2 (PPM)  
B9CPNOX (PPM)  
B9CPSO2 (PPM)  
B9FFACT (MMBTU/JCF)  
B9NOX#M (#MMBTU)  
B9PCO (PPM)  
B9SO2#M (#MMBTU)  
B9STEAM (KLBSHR)

1 of 1

MPU01844

# Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/23/2013 23:45 Through 07/24/2013 00:05

Time Online Criteria: 1 minute(s)

Source	B9						B9SO2#M (#MMBTU)	B9STEAM (KLBS/HR)
	B9CO#M (#MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFFACT (MMBTU/CF)	B9NOX#M (#MMBTU)		
07/23/13 23:45	0.022	10.0	51.8	83.1	1,833.0	0.113	16.2	0.253
07/23/13 23:46	0.023	10.0	52.1	82.5	1,833.0	0.114	17.4	0.251
07/23/13 23:47	0.020	10.0	51.3	86.8	1,833.0	0.112	14.8	0.264
07/23/13 23:48	0.019	10.0	51.8	89.0	1,833.0	0.113	14.5	0.271
07/23/13 23:49	0.022	10.1	52.2	87.2	1,833.0	0.113	16.6	0.263
07/23/13 23:50	0.023	10.1	53.9	81.7	1,833.0	0.117	17.2	0.246
07/23/13 23:51	0.021	10.1	54.0	79.8	1,833.0	0.117	15.6	0.240
07/23/13 23:52	0.021	10.1	55.9	76.5	1,833.0	0.121	15.5	0.230
07/23/13 23:53	0.022	10.9	57.0	73.7	1,833.0	0.125	16.8	0.224
07/23/13 23:54	0.021	10.1	56.4	75.3	1,833.0	0.122	15.7	0.227
07/23/13 23:55	0.024	9.9	56.3	77.7	1,833.0	0.124	17.7	0.239
07/23/13 23:56	0.024	9.9	55.9	80.5	1,833.0	0.124	18.0	0.247
07/23/13 23:57	0.023	10.0	53.4	85.6	1,833.0	0.117	17.5	0.260
07/23/13 23:58	0.026	10.0	54.0	84.2	1,833.0	0.118	19.4	0.256
07/23/13 23:59	0.025	10.0	53.8	83.8	1,833.0	0.118	18.6	0.255
07/24/13 00:00	0.023	9.9	51.3	79.8	1,833.0	0.113	17.2	0.245
07/24/13 00:01	0.024	10.1	51.7	78.4	1,833.0	0.112	18.5	0.236
07/24/13 00:02	0.026	10.0	53.6	70.3	1,833.0	0.117	19.6	0.214
07/24/13 00:03	0.025	10.0	53.4	72.5	1,833.0	0.117	19.0	0.221
07/24/13 00:04	0.026	10.1	54.6	71.9	1,833.0	0.118	19.7	0.217
07/24/13 00:05	0.027	9.9	53.3	73.4	1,833.0	0.118	20.3	0.226
35								
Average	0.023	10.0	53.7	79.7	1,833.0	0.117	17.4	0.242
Minimum	0.019	9.9	51.3	70.3	1,833.0	0.112	14.5	0.214
Maximum	0.027	10.1	57.0	89.0	1,833.0	0.125	20.3	0.271
Summation	0.487	210.3	1,127.7	1,673.7	38,493.0	2,463	365.8	5,095
Included Data Points	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21

Average 0.023  
 Minimum 0.019  
 Maximum 0.027  
 Summation 0.487  
 Included Data Points 21  
 Total number of Data Points 21

F = Unit Offline      E = Exceedance      C = Calibration      S = Substituted  
 M = Maintenance      T = Out Of Control      \* = Suspect      U = Startup      D = Shutdown  
 Report Generated: 07/24/13 00:08      Report Version 3.1.1130      STACKVISION2/reportuser

MPU01845  
 1 of 1  
 Run 6  
 7/24/2013 00:00:00  
 7/24/2013 00:05:00

B9 Gas Rate  
Run 7

## Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll with BAF Applied

Report Period: 07/24/2013 00:20 Through 07/24/2013 00:40

Time Online Criteria: 1 minute(s)

Source	B9						B9STEAM (KLBS/HR)		
	B9CO#M (#MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#MMBTU)	B9PCO (PPM)	B9SO2#M (#MMBTU)	
07/24/13 00:20	0.031	10.2	43.2	101.2	1,833.0	0.093	23.6	0.302	185
07/24/13 00:21	0.030	10.2	45.1	100.3	1,833.0	0.097	22.5	0.299	184
07/24/13 00:22	0.028	10.0	45.2	90.1	1,833.0	0.089	21.1	0.274	179
07/24/13 00:23	0.027	10.1	44.2	55.9	1,833.0	0.096	20.2	0.289	181
07/24/13 00:24	0.025	10.1	43.7	102.4	1,833.0	0.095	19.2	0.308	180
07/24/13 00:25	0.026	10.2	44.8	98.6	1,833.0	0.096	20.2	0.284	185
07/24/13 00:26	0.027	10.3	46.5	55.7	1,833.0	0.099	21.0	0.283	184
07/24/13 00:27	0.029	10.3	48.9	92.6	1,833.0	0.104	22.1	0.274	180
07/24/13 00:28	0.026	10.0	50.6	84.4	1,833.0	0.111	19.8	0.257	183
07/24/13 00:29	0.026	10.0	50.3	87.0	1,833.0	0.110	19.2	0.265	183
07/24/13 00:30	0.028	10.0	48.6	87.2	1,833.0	0.106	21.1	0.265	180
07/24/13 00:31	0.026	10.0	46.6	96.5	1,833.0	0.102	19.8	0.294	180
07/24/13 00:32	0.028	10.1	46.3	98.4	1,833.0	0.100	21.1	0.296	179
07/24/13 00:33	0.027	10.0	44.8	100.5	1,833.0	0.098	20.5	0.306	180
07/24/13 00:34	0.026	10.1	46.2	99.5	1,833.0	0.100	19.3	0.300	184
07/24/13 00:35	0.024	10.1	46.3	96.6	1,833.0	0.100	18.4	0.291	185
07/24/13 00:36	0.025	10.2	46.2	104.7	1,833.0	0.099	19.1	0.312	182
07/24/13 00:37	0.024	10.2	49.8	97.3	1,833.0	0.107	18.8	0.290	180
07/24/13 00:38	0.025	10.2	50.6	93.4	1,833.0	0.109	19.2	0.279	181
07/24/13 00:39	0.028	10.0	50.2	91.5	1,833.0	0.110	21.0	0.278	179
07/24/13 00:40	0.028	10.1	50.0	90.8	1,833.0	0.108	21.0	0.274	179
<hr/>									
Average	0.027	10.1	47.1	95.5	1,833.0	0.102	20.4	0.287	182
Minimum	0.024	10.0	43.2	84.4	1,833.0	0.093	18.4	0.257	179
Maximum	0.031	10.3	50.6	104.7	1,833.0	0.111	23.6	0.312	185
Summation	0.564	212.4	988.1	2,004.6	38,483.0	2,139	428.2	6,030	3,813
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points									

Average  
Minimum  
Maximum  
Summation  
Included Data Points  
Total number of Data Points

F = Unit Offline      E = Exceedance      S = Substituted      I = Interim  
 M = Maintenance      T = Out Of Control      \* = Suspect      U = Startup      D = Shutdown  
 Report Generated: 07/24/13 00:43      Report Version 3.1.130      STACKVISION2 report user  
 1 of 1

# B9 Gas Data

## Run 8

**Average Data**  
 Plant: Manitowoc Public Utilities  
 Interval: 1 Minute  
 Type: Roll with BAF Applied  
 Report Period: 07/24/2013 00:50 Through 07/24/2013 01:10  
 Time Online Criteria: 1 minute(s)

Source	B9						B9SO2#M (#MMBTU)			B9STEAM (KLBS/HR)	
	Parameter Unit	B9CO#M (#MMSTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#MMBTU)	B9PCO (PPM)	B9SO2#M (#MMBTU)	B9STEAM (KLBS/HR)	
07/24/13 00:50	0.024	10.1	51.3	89.7	1,833.0	0.111	18.1	0.270	177		
07/24/13 00:51	0.025	10.1	52.4	87.2	1,833.0	0.114	19.0	0.263	177		
07/24/13 00:52	0.023	10.1	52.1	83.8	1,833.0	0.113	17.8	0.252	182		
07/24/13 00:53	0.028	10.2	53.6	79.1	1,833.0	0.115	21.8	0.236	181		
07/24/13 00:54	0.027	10.1	53.7	72.9	1,833.0	0.116	20.6	0.220	183		
07/24/13 00:55	0.024	10.1	54.2	73.1	1,833.0	0.117	18.2	0.220	179		
07/24/13 00:56	0.024	10.1	52.1	82.1	1,833.0	0.113	18.5	0.247	177		
07/24/13 00:57	0.027	10.2	52.3	90.5	1,833.0	0.112	20.3	0.270	179		
07/24/13 00:58	0.023	10.1	54.5	86.8	1,833.0	0.118	17.5	0.261	181		
07/24/13 00:59	0.021	10.1	55.5	79.2	1,833.0	0.120	15.9	0.239	182		
07/24/13 01:00	0.025	10.1	55.7	76.9	1,833.0	0.121	18.6	0.232	181		
07/24/13 01:01	0.025	10.2	56.8	75.5	1,833.0	0.122	19.3	0.225	177		
07/24/13 01:02	0.023	10.1	57.9	73.3	1,833.0	0.125	17.6	0.221	178		
07/24/13 01:03	0.025	10.2	57.0	72.9	1,833.0	0.122	19.1	0.217	183		
07/24/13 01:04	0.025	10.2	56.7	71.4	1,833.0	0.122	19.2	0.213	182		
07/24/13 01:05	0.023	10.1	56.0	73.2	1,833.0	0.121	17.3	0.221	178		
07/24/13 01:06	0.025	10.2	57.9	77.3	1,833.0	0.124	18.9	0.231	179		
07/24/13 01:07	0.024	10.2	57.6	77.1	1,833.0	0.124	18.3	0.230	179		
07/24/13 01:08	0.025	10.1	60.3	69.6	1,833.0	0.131	18.8	0.210	183		
07/24/13 01:09	0.026	10.2	61.5	66.5	1,833.0	0.132	19.9	0.198	184		
07/24/13 01:10	0.026	10.0	59.9	63.6	1,833.0	0.131	19.8	0.194	179		
Average	0.025	10.1	55.7	77.2	1,833.0	0.120	18.8	0.232	180		
Minimum	0.021	10.0	51.3	63.6	1,833.0	0.111	15.9	0.194	177		
Maximum	0.028	10.2	61.5	90.5	1,833.0	0.132	21.8	0.270	184		
Summation	0.518	212.8	1,169.0	1,621.7	38,493.0	2,524	394.5	4,870	3,781		
Included Data Points	21	21	21	21	21	21	21	21	21		
Total number of Data Points	21	21	21	21	21	21	21	21	21		

F = Unit Offline    E = Exceedance    S = Substituted    I = Invalied  
 M = Maintenance    T = Out Of Control    U = Startup    D = Shutdown  
 \* = Suspect    Report Generated: 07/24/13 01:11    Report Version 3.1.1130  
 STACKVISION2 report user

B9 Log's DATA  
Run 9

## Average Data

Plant: Manitowoc Public Utilities  
Interval: 1 Minute

Type: Roll

Report Period: 07/24/2013 01:20 Through 07/24/2013 01:40  
Time Online Criteria: 1 minute(s)

Source	B9						B9STEAM (KLBS/HR)		
	Parameter Unit	B9CO2#M (#MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#MMBTU)	B9PCO (PPM)	B9SO2#M (#MMBTU)
07/24/13 01:20	0.026	10.2	63.7	74.6	1,833.0	0.137	19.9	0.223	183
07/24/13 01:21	0.022	10.2	63.4	68.8	1,833.0	0.136	17.1	0.205	179
07/24/13 01:22	0.023	10.1	62.5	70.4	1,833.0	0.135	17.7	0.212	180
07/24/13 01:23	0.022	10.1	64.1	68.8	1,833.0	0.139	16.8	0.207	180
07/24/13 01:24	0.019	10.1	64.8	67.9	1,833.0	0.140	14.7	0.205	178
07/24/13 01:25	0.022	10.2	64.7	68.3	1,833.0	0.139	16.7	0.204	184
07/24/13 01:26	0.025	10.1	66.2	64.7	1,833.0	0.143	18.7	0.195	183
07/24/13 01:27	0.024	10.1	67.1	57.4	1,833.0	0.145	18.4	0.173	180
07/24/13 01:28	0.024	10.1	65.5	62.5	1,833.0	0.142	18.1	0.188	180
07/24/13 01:29	0.023	10.1	65.5	69.5	1,833.0	0.142	17.3	0.209	178
07/24/13 01:30	0.025	10.2	63.3	74.6	1,833.0	0.136	19.2	0.223	180
07/24/13 01:31	0.023	10.1	63.1	72.7	1,833.0	0.137	17.3	0.219	184
07/24/13 01:32	0.023	10.2	62.8	74.3	1,833.0	0.135	17.3	0.222	184
07/24/13 01:33	0.024	10.2	62.9	77.4	1,833.0	0.135	18.1	0.231	183
07/24/13 01:34	0.023	10.2	62.6	76.6	1,833.0	0.134	17.9	0.229	183
07/24/13 01:35	0.023	10.3	64.6	75.1	1,833.0	0.137	18.0	0.222	181
07/24/13 01:36	0.023	10.1	61.1	77.3	1,833.0	0.132	17.7	0.233	180
07/24/13 01:37	0.025	10.3	65.6	77.0	1,833.0	0.139	19.0	0.227	183
07/24/13 01:38	0.024	10.2	67.6	76.2	1,833.0	0.145	18.3	0.227	180
07/24/13 01:39	0.024	10.2	70.0	71.2	1,833.0	0.150	18.3	0.212	181
07/24/13 01:40	0.023	10.1	70.4	69.5	1,833.0	0.153	17.3	0.209	184
Average			64.8	71.2	1,833.0	0.140	17.8	0.213	181
Minimum	0.023	10.2	61.1	57.4	1,833.0	0.132	14.7	0.173	178
Maximum	0.019	10.1	70.4	77.4	1,833.0	0.153	19.9	0.233	184
Summation	0.026	10.3	1,361.5	1,494.8	38,493.0	2,931	373.8	4,475	3,808
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21							

# Average Data

Plant: Manitowoc Public Utilities  
Interval: 1 Minute

Type: Roll

Report Period: 07/24/2013 01:50 Through 07/24/2013 02:10  
Time Online Criteria: 1 minute(s)

B9 Gas Data  
Run 10

Source	B9						B9SO2#M (#MMBTU)	B9PCO (PPM)	B9STEAM (KLBS/HR)
	Parameter	B9CO#M (#MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)			
07/24/13 01:50	0.025	10.0	65.9	77.7	1,833.0	0.144	18.3	0.236	180
07/24/13 01:51	0.024	10.0	65.3	78.4	1,833.0	0.143	17.9	0.239	178
07/24/13 01:52	0.024	10.0	65.7	73.7	1,833.0	0.144	18.4	0.224	179
07/24/13 01:53	0.021	10.0	65.9	73.4	1,833.0	0.144	15.7	0.223	179
07/24/13 01:54	0.023	10.0	65.7	75.5	1,833.0	0.144	17.4	0.230	179
07/24/13 01:55	0.024	10.0	65.9	70.3	1,833.0	0.144	18.0	0.214	182
07/24/13 01:56	0.024	10.1	65.6	67.7	1,833.0	0.142	17.9	0.204	179
07/24/13 01:57	0.026	10.0	66.3	63.7	1,833.0	0.145	19.1	0.194	180
07/24/13 01:58	0.025	10.0	67.3	63.9	1,833.0	0.147	18.9	0.194	180
07/24/13 01:59	0.023	10.1	66.1	67.9	1,833.0	0.143	17.4	0.205	181
07/24/13 02:00	0.025	10.1	66.0	65.9	1,833.0	0.143	18.6	0.199	183
07/24/13 02:01	0.024	10.2	67.1	67.0	1,833.0	0.144	18.3	0.200	181
07/24/13 02:02	0.024	10.0	66.2	67.9	1,833.0	0.145	17.8	0.207	177
07/24/13 02:03	0.024	10.2	67.9	68.9	1,833.0	0.146	18.5	0.206	179
07/24/13 02:04	0.024	10.1	68.9	70.0	1,833.0	0.149	18.5	0.211	182
07/24/13 02:05	0.026	10.1	67.6	74.8	1,833.0	0.146	19.6	0.225	182
07/24/13 02:06	0.023	10.1	69.1	74.8	1,833.0	0.150	17.8	0.225	183
07/24/13 02:07	0.024	10.0	65.7	75.8	1,833.0	0.144	18.3	0.231	183
07/24/13 02:08	0.023	10.1	65.6	72.8	1,833.0	0.142	17.5	0.219	181
07/24/13 02:09	0.025	10.2	64.9	74.7	1,833.0	0.139	19.2	0.223	181
07/24/13 02:10	0.024	10.2	66.3	72.4	1,833.0	0.142	18.1	0.216	181
Average	0.024	10.1	66.4	71.3	1,833.0	0.144	18.2	0.215	
Minimum	0.021	10.0	64.9	63.7	1,833.0	0.139	15.7	0.194	
Maximum	0.026	10.2	69.1	78.4	1,833.0	0.150	19.6	0.239	
Summation	0.505	211.5	1,395.0	1,497.2	38,493.0	3,030	381.2	4,525	
Included Data Points	21	21	21	21	21	21	21	21	
Total number of Data Points	21								

## **APPENDIX I**

### **PROCEDURES**

Please Note: In an effort to conserve paper, the procedure section of the appendix has been reserved for explanations of EPA methodology deviations. Please refer to the specific EPA Methods on the following EPA website:

<http://www.epa.gov/ttn/emc/>

## **APPENDIX J**

### **CALCULATION EQUATIONS**

LB/mmBtu		Equations - CFR 40, Part 60, Method 19
Calculator		
SO2 : Calculator	SO2 ppm,w = CO2 %,w = F-factor (Fc) = lb/million Btu =	55.4 10 1877 0.17269617
NOx : Calculator	NOx ppm,w = CO2 %,w = F-factor (Fc) = lb/million Btu =	57.4 10 1877 0.12860899
CO :	CO ppm,w = CO2 %,w = F-factor (Fc) = lb/million Btu =	13.3 10 1877 0.018138915
		SO2 : Equations 19-7      Using the wet SO2 and CO2 numbers. $F_c * 0.000000002595 * 64 * 100 * SO2 \text{ ppm (wet)} / CO2 \% (wet)$
		NOx : Equations 19-7      Using wet NOx and CO2 numbers. $F_c * 0.000000002595 * 46 * 100 * NOx \text{ ppm (wet)} / CO2 \% (wet)$
		CO : 19-7      Using the CO and CO2 wet numbers. $F_c * 0.000000002595 * 28 * 100 * CO \text{ ppm (wet)} / CO2 \% (wet)$

$$S_d = \left[ \frac{\sum_{i=1}^n d_i^2 - \left[ \sum_{i=1}^n d_i \right]^2 / n}{n-1} \right]^{1/2} \quad Eq. 2-4$$

12.4 Confidence Coefficient. Calculate the 2.5 percent error confidence coefficient (one-tailed), CC, as follows:

$$CC = t_{0.975} \frac{S_d}{\sqrt{n}} \quad Eq. 2-5$$

Where:

$t_{0.975}$ =t-value (see Table 2-1).

12.5 Relative Accuracy. Calculate the RA of a set of data as follows:

$$RA = \frac{\left[ |\bar{d}| + |CC| \right]}{RM} \times 100 \quad Eq. 2-6$$

Where:

$|\bar{d}|$ =Absolute value of the mean differences (from Equation 2-3).

$|CC|$ =Absolute value of the confidence coefficient (from Equation 2-3).

RM=Average RM value. In cases where the average emissions for the test are less than 50 percent of the applicable standard, substitute the emission standard value in the denominator of Eq. 2-6 in place of RM. In all other cases, use RM.

### 13.0 Method Performance

13.1 Calibration Drift Performance Specification. The CEMS calibration must not drift or deviate from the reference value of the gas cylinder, gas cell, or optical filter by more than 2.5 percent of the span value. If the CEMS includes pollutant and diluent monitors, the CD must be determined separately for each in terms of concentrations (See Performance Specification 3 for the diluent specifications), and none of the CDs may exceed the specification.

13.2 Relative Accuracy Performance Specification. The RA of the CEMS must be no greater than 20 percent when RMs used in the denominator of Eq. 2-6 (average emissions during test are greater than 50 percent of the emission standard) or 10 percent when the applicable emission standard is used in the denominator of Eq. 2-6 (average emissions during test are less than 50 percent of the emission standard). For SO<sub>2</sub>emission standards of 130 to and including 86 ng/J (0.30 and 0.20 lb/million Btu), inclusive, use 15 percent of the applicable standard; below 86 ng/J (0.20 lb/million Btu), use 20 percent of the emission standard.

## **APPENDIX K**

### **AETB REQUIREMENTS**



Interpoll Laboratories, Inc.  
4500 Ball Road NE  
Circle Pines, MN 55014-1819  
Tel: 763-786-6020  
Fax: 763-786-7854  
[www.interpoll-labs.com](http://www.interpoll-labs.com)

August 19, 2013

Manitowoc Public Utilities  
Thomas E. Reed  
1303 South 8<sup>th</sup> Street  
P.O. Box 1090  
Manitowoc, WI 54221-1090

Re: Part 75 Air Emission Testing Body Requirements

Mr. Reed

This letter addresses the requirements of 40 CFR Part 75. Specifically; effective March 27, 2012, 40 CFR Part 75 test programs must be conducted by an Air Emissions Testing Body (AETB) in accordance with the requirements set forth in ASTM D 7036-04, Standard Practice for Competent Air Emission Testing Body.

Consistent with Section 6.2.1(c), Appendix A, 40 CFR Part 75, the AETB shall provide to each customer a certification that the AETB operates in conformance with, and that data has been collected in accordance with, the requirements of ASTM D 7036-04.

This letter serves as certification that Interpoll Laboratories, Inc. does provide data and services which comply with the above requirements.

Regards,

A handwritten signature in black ink, appearing to read "Daniel Despen". It is written in a cursive style with a long horizontal line extending from the end of the signature.

Daniel Despen  
President  
Interpoll Laboratories, Inc.

**Stack Vision Entry Requirements****Required AETB Data Per Part 75**

Field	Entry	Description
Q1 Last Name	Aaron	Required-Qualified individual's last name
Q1 First Name	Wilson	Required-Qualified individual's first name
Q1 Middle Initial	M.	Required-Qualified individual's middle initial
AETB Name	Interpoll Laboratories, Inc.	Required-The AETB company whom the Qualified Individual represents.
AETB Phone Number	763-786-6020	Required-AETB company phone number.
AETB Email	<u>stack@interpoll-labs.com</u>	Required-AETB company email address or the email address of the qualified individual.
Exam Date	1/13/2012	Required-Date the Qualified Individual completed the AETB exam that certifies this person to conduct RATA tests.
Exam Provider Name	Source Evaluation Society	Required-Name of the agency who provided the exam
Exam Provider Email	<u>qstiprogram@gmail.com</u>	Required-Email address for the agency who provided the exam.
Comment		Optional field for additional comments.

**Note:** Interpoll Laboratories will be providing a letter of certification signed by a member of the senior management staff of the AETB for the clients records.